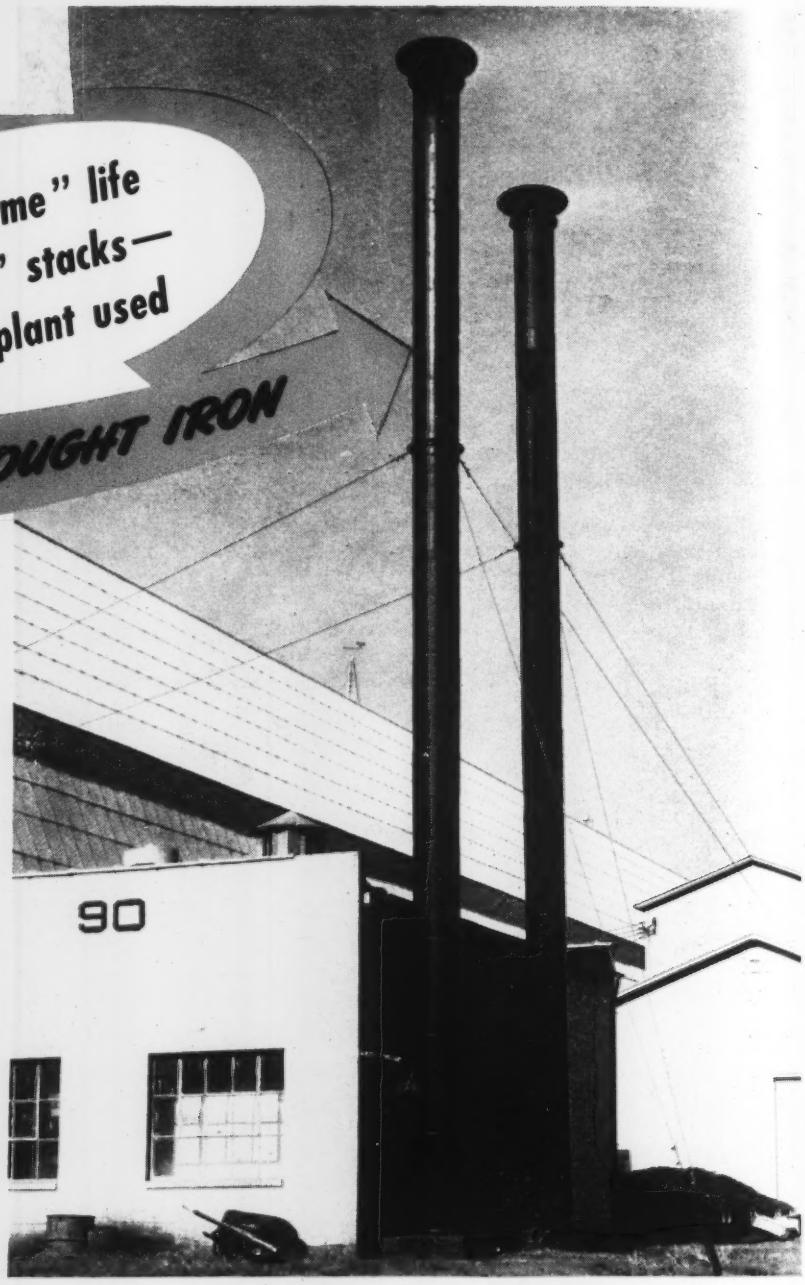
ENGINEERING NEWS-RECORD

A McGRAW-HILL PUBLICATION

OCTOBER 2, 1947

Gantry cranes being readied for
ncr te placing operations at Davis Dam

For "full-time" life from "part-time" stacks— this plant used BYERS WROUGHT IRON



One of the most punishing conditions that a stack has to face is intermittent operation. Periods of idleness are generally more destructive than equal periods of use.

Three stacks at the Goodyear Aircraft Corporation at Wingfoot Lake, Akron, Ohio had such part-time jobs. Although capped, they failed in a relatively short time, and the engineers cast about for a more durable material. Byers wrought iron was used. Two of the new stacks, each 24-inches by 50-feet, are illustrated. They are fabricated from ¼-inch wrought iron plates and are welded throughout. Guy wire rings are formed from ⅜-inch wrought iron angles, cold bent to shape.

Under the best conditions, stacks must withstand severe corrosive attack. Carbon and sulfur compounds in the smoke will, if absorbed by moisture, form highly aggressive acids, that are extremely destructive to ordinary materials. Wrought iron has been very successfully used in this service. Its most impressive demonstrations have been made in installations where it was combined with low-first-cost materials, which permitted a direct comparison under identical conditions. In one such instance, a four to one life ratio was registered by wrought iron. Reports of two and three times as much service from wrought iron as from ordinary materials are common.

The reason for wrought iron's excellent service is found in its unique composition and structure. Tiny fibers of glass-like silicate slag, threaded through a body of high purity iron, halt and "detour" corrosive attack. This discourages pitting and rapid penetration. The fibers also help anchor the initial protective scale, which shields the underlying metal.

Our bulletin, "Wrought Iron for Flue Gas Conductors and Coal Handling Equipment," will give you helpful information on how wrought iron is helping others . . . and may help you.

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, Seattle, San Francisco.

CORROSION COSTS YOU MORE THAN WROUGHT IRON

BYERS
GENUINE WROUGHT IRON
TUBULAR AND HOT ROLLED PRODUCTS
ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

ENGINEERING NEWS-RECORD

Volume 139 • Number 14 OCTOBER 2, 1947

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ENGINEERING NEWS-RECORD
Published By
McGRAW-HILL PUBLISHING CO., INC.

Publication Office:
99-129 N. Broadway, Albany 1, N. Y.

Editorial and Executive Office:
330 W. 42nd St., New York 18, N. Y.

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Number of Copies of this issue printed 43,420

INDEX FOR VOLUME 138

An index for Volume 138 (January-June 1947) was published during the latter part of July. Copies will be mailed to subscribers who ordered an index for Volumes 136 and 137. Subscribers who did not order a copy of that index or who have changed their address should return this coupon to

The Editor, Engineering News-Record
330 West 42nd St., New York 18, N. Y.

Name .....

Street .....

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ENGINEERING NEWS-RECORD. Published every Thursday. Publication office: 99-129 North Broadway, Albany 1, N. Y. Return postage guaranteed. Editorial and Executive Office: 330 West 42nd St., New York 18. Vol. 139, No. 14. Price 35c per copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd Street, New York 18, N. Y. Subscriptions, United States and U. S. Possessions, $6.00 for one year, $9.00 for two years, $12.00 for three years. Canada $7.00 for one year, $11.00 for two years, $14.00 for three years. Latin American countries $10.00 for one year, $16.00 for two years, $20.00 for three years. All other countries, $20.00 for one year, $30.00 for two years, $40.00 for three years. Please indicate position and company connection on all subscription orders. Entered as second class matter October 29, 1936, at the Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in the U.S.A.

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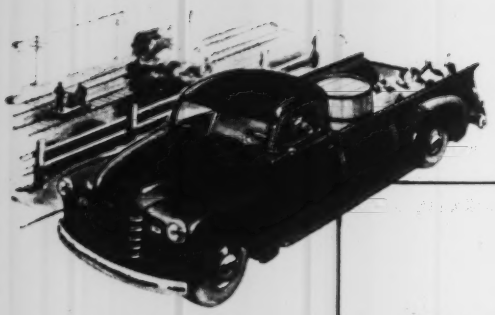

Panels and pick-ups have **INCREASED LOAD SPACE**—stake and high rack bodies **MORE EFFICIENT LOADING.** . . . New stronger, sturdier **FRAMES** are designed to carry greater loads greater distances for a longer time!

THE CAB THAT "BREATHES"—fresh air is *drawn in* from the outside—heated in cold weather—and used air is *forced out!* It's roomier, much more comfortable, with 12 inches more foot room—eight inches more seating space!

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Power . . . When It's Needed . . . Where It's Needed!

Wider, deeper **WINDSHIELD** and **WINDOWS** increase visibility by 22%! New rear-corner windows, permitting even greater visibility are available as optional equipment at extra cost.

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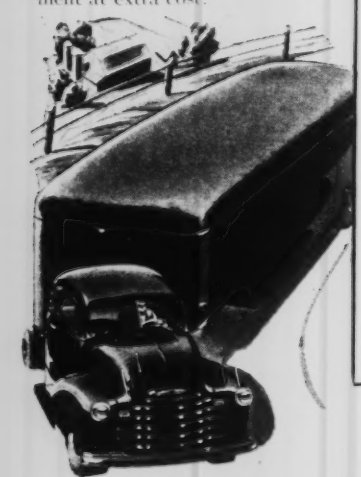
See the cab that "breathes"*

All over the country, truck users praise the rugged, reliable performance of the famous Chevrolet Valve-in-Head Load-Master engine, developing its peak power at low speeds for long life and lasting economy. See these new trucks with their sensational new features and innovations—today!

**Fresh-air heating and ventilating system optional at extra cost.*

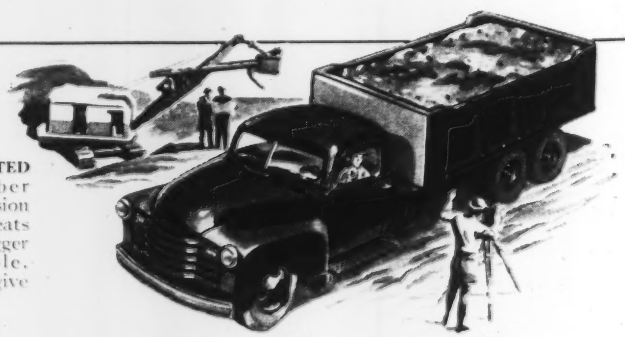
CHOOSE CHEVROLET TRUCKS FOR TRANSPORTATION UNLIMITED!

CHEVROLET MOTOR DIVISION, *General Motors Corporation*, DETROIT 2, MICHIGAN



VALVE-IN-HEAD TRUCK ENGINES are world's most economical for their size. . . . Chevrolet's **HYDRAULIC TRUCK BRAKES** are *exclusively* designed for greater brake-lining contact and positive action!

The cab is **FLEXI-MOUNTED**—cushioned on rubber against road shocks, torsion and vibration! . . . The seats are fully adjustable, bigger and more comfortable. **LONGER WHEELBASES** give better load distribution.



Construction Trends

Construction Employment Below a Year Ago

Construction employment, as estimated by the Bureau of Labor Statistics, staged a seasonal recovery during the past six months, rising to 2,239,000 employed construction workers in August from the seasonal low of 1,559,000 workers in February of this year. Total employment in August, however, was 2.7 percent below the corresponding 1946 month, when 2,300,000 workers were employed in the construction industry.

Employment on public construction projects of 461,000 workers accounted for 21 percent of total construction employment in August, 1947, while employment of 1,778,000 workers on private construction jobs accounted for 79 percent of the total. In August, 1946, 8 percent of the total number of workers were employed on public projects and 92 percent on private construction projects.

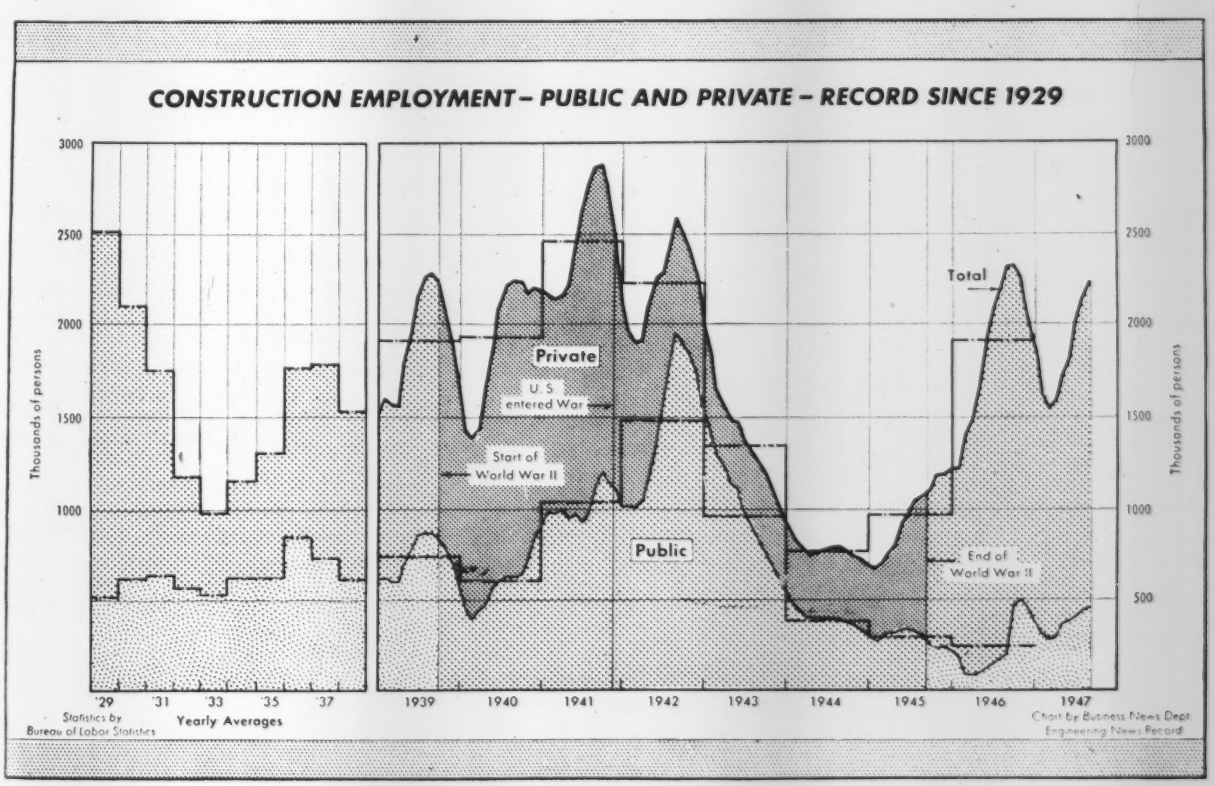
For the first four months of 1947, construction employment ran ahead of a year ago, showing an 11.5 percent gain on the average over the corresponding period of 1946. From May through August, however, seasonal gains in construction employment slowed down, and the average number of workers employed during this period dropped 3.4 percent below a year ago.

The relative trend of construction employment compared with a year ago, is in keeping with construction activity as measured by *Engineering News-Record's* construction contract awards. The volume of construction contracts awarded from January through April of this year was 8.3 percent ahead of a year ago, while contracts awarded during the next four-month period ran 9.2 percent below the comparable 1946 period.

Engineering News-Record's survey of the supply of construction labor in 54 U. S. cities as of September 1 indicates a plentiful supply of common labor for construction in nearly all of the reporting cities. Skilled labor shortages, however, have been reported in 42 cities, with the greatest scarcities evident among bricklayers, plasterers and lathers.

TOTAL CONSTRUCTION EMPLOYMENT
Bureau of Labor Statistics
(In Thousands)

	1939	1940	1941	1942	1943	1944	1945	1946	1947
January	1582	1420	2073	1960	1827	827	671	1223	1628
February	1564	1367	2047	1902	1653	779	708	1406	1559
March	1552	1418	2078	1912	1551	746	758	1497	1580
April	1813	1657	2216	2106	1482	759	809	1681	1767
May	1973	1872	2448	2251	1465	769	908	1927	1813
June	2144	2090	2615	2292	1365	779	970	2072	2000
July	2249	2210	2774	2453	1301	787	1043	2182	2138
August	2276	2228	2863	2579	1254	790	1065	2300	2239
September	2215	2220	2879	2469	1177	760	1047	2313	...
October	2035	2146	2698	2400	1083	741	1175	2250	...
November	1853	2186	2498	2262	996	720	1183	2057	...
December	1650	2173	2160	1987	905	683	1215	1846	...
Average	1909	1916	2446	2214	1338	762	967	1896	....



The Steel Rush of '47

Back in 1849, the cry of "*Gold*" sent a horde of men racing westward. Yes, there was gold in California—but not enough for all who hungered for it. Latecomers in the rush found themselves with worthless claims. Others found nothing at all.

Today the cry is for steel. After six long years of war, strikes and stoppages, an equipment-hungry nation is creating history's greatest demand for steel products.

Every day by mail, telephone and telegraph—a steady stream of orders pours into each of twelve great Ryerson plants. And, though steel production is now far above the pre-war level, the tremendous demand sometimes depletes our stocks. Often we are unable to ship many items on your order.

But, unlike the gold supply that faded before the eyes of the hapless Forty-niners, the supply of steel is being constantly replenished. Products out of stock today may be available the next time you check the nearby Ryerson plant.

And here at Ryerson trained personnel and the facilities of a complete Steel-Service system combine in a concentrated effort to deliver your steel requirements promptly. When the steel you need is not immediately available, we gladly assist you in the search for a practical alternate.

Today, during history's greatest steel rush, this guarantee of full co-operation and service is especially valuable. That's why so many steel users contact Ryerson for all requirements.

Joseph T. Ryerson & Son, Inc. Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL

New Construction Volume in September

Civil engineering construction volume in continental United States totals $494,805,000 for September, an average of $123,701,000 for each of the four weeks of the month. This average is 20 percent above the average for August, and 33 percent above the average for September, 1946, according to *Engineering News-Record*.

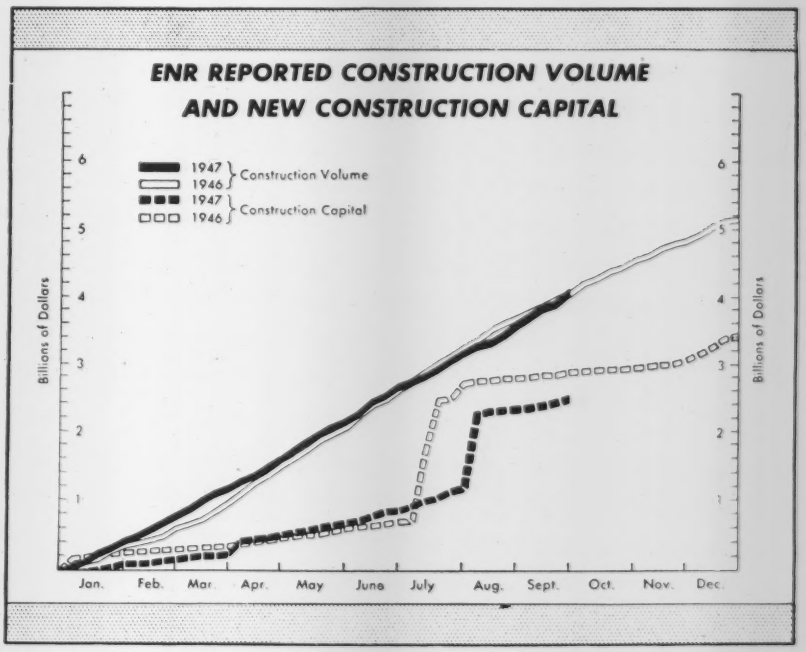
Private construction for September on a weekly average basis is 35 percent above last month, and 31 percent above September, 1946. Public construction is 1 percent above last month, and 35 percent above last September. State and municipal construction is 5 percent above last month, and 30 percent above the average for September, 1946. Federal construction, down 10 percent from last month, is 58 percent above September, 1946.

Weekly averages in the various classes of construction for September, 1947 compared with August, 1947 show gains in earthwork and drainage, of 304 percent; commercial buildings, 52 percent; public unclassified, 45 percent; private unclassified, 28 percent; public bridges, 16 percent; and industrial buildings, 14 percent. Losses are recorded for waterworks, 1 percent; sewerage, 5 percent; highways, 6 percent; and public buildings, 38 percent.

Geographically, three sections showed gains in September, 1947 over August—West of the Mississippi, 113 percent; New England, 102 percent; and South, 19 percent. Middle Atlantic dropped 8 percent; Middle West, 11 percent; and Far West, 17 percent.

Three sections made gains in September over September, 1946—West of the Mississippi, 144 percent; Middle Atlantic, 72 percent; and Far West, 6 percent. New England dropped 5 percent below last year; Middle West, 5 percent; and South, 25 percent.

New capital for construction for the four weeks of September, 1947 totals $150,578,000, or a weekly average of $37,645,000 for the month. The weekly average is thus 87 percent below the weekly average of $290,797,000 for August, 1947 which included new federal appropriations for the present fiscal year.



ENGINEERING CONSTRUCTION CONTRACTS REPORTED TO ENGINEERING NEWS-RECORD—SEPTEMBER, 1947

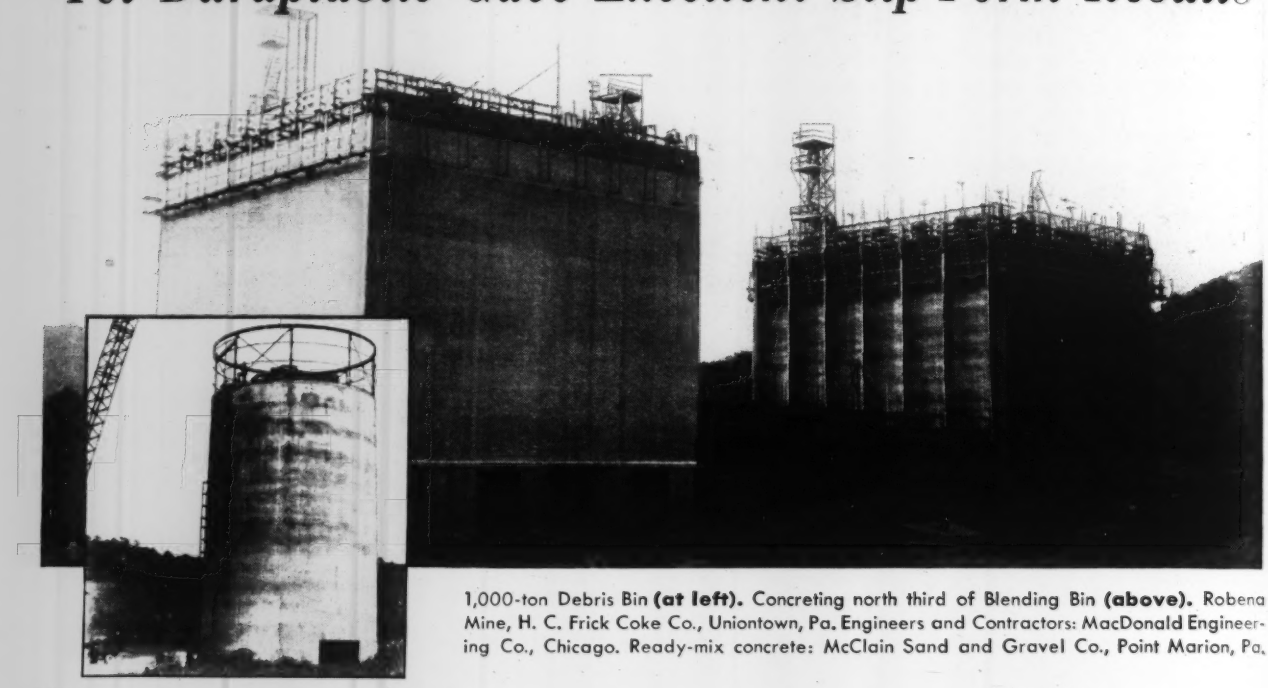
Engineering News-Record *reports continental U. S. Construction projects of the following minimum costs — Waterworks, excavation, drainage and irrigation,* $22,500; *other public works,* $40,000; *industrial buildings,* $55,000; *other buildings,* $205,000

Four Weeks — Thousands of Dollars (000 Omitted)

	New England	Middle Atlantic	South	Mid West	West of Mississippi	Far West	United States September 1947	United States Nine Months 1947	United States Nine Months 1946	Canada
Public Works										
Waterworks	.....	1,313	869	338	3,828	1,845	8,193	82,174	78,407	681
Sewerage	55	1,699	2,086	5,356	2,276	1,976	13,448	103,963	77,379	1,027
Bridges, public	984	3,450	2,614	2,525	4,536	2,379	16,488	131,540	103,200	193
Earthwork and waterways	43	407	2,747	976	27,171	1,120	32,464	231,204	312,736	894
Streets and roads	2,539	15,143	9,557	19,846	13,252	5,152	65,489	609,727	602,002	357
Buildings, public	2,877	8,826	11,797	4,901	4,831	6,651	39,883	430,085	293,565	14,863
Unclassified, public	1,402	1,910	1,856	2,657	2,890	6,340	17,055	197,396	131,677	11,010
Total public	**7,900**	**32,748**	**31,526**	**36,599**	**58,784**	**25,463**	**193,020**	**1,786,089**	**1,598,966**	**29,025**
Federal government (included in above classifications)	738	3,343	2,478	2,074	28,902	2,506	40,041	493,114	540,117	.....
Private										
Bridges, private	.....	.....	.....	.....	.....	.....	.....	824	1,761	.....
Industrial buildings	10,813	29,346	8,207	6,125	34,976	1,698	91,165	651,541	797,516	6,475
Commercial buildings	7,008	56,577	23,893	15,292	52,917	21,346	177,033	1,343,699	1,520,497	2,570
Unclassified, private	121	55	3,597	5,698	16,544	7,572	33,587	324,249	164,421	3,960
Total private	**17,942**	**85,978**	**35,697**	**27,115**	**104,437**	**30,616**	**301,785**	**2,320,313**	**2,484,195**	**9,705**
Total Engineering Construction;										
September, 1947 — 4 weeks	**25,842**	**118,726**	**67,223**	**63,714**	**163,221**	**56,079**	**494,805**	.....	.....	**38,730**
August, 1947 — 4 weeks	12,814	129,031	56,451	71,257	76,725	67,216	413,494	.....	.....	19,034
September, 1946 — 4 weeks	27,263	68,866	90,078	66,982	66,820	53,047	373,056	.....	.....	24,633
Nine months — 1947	**160,013**	**1,052,995**	**704,820**	**559,976**	**970,928**	**657,670**	.....	**4,106,402**	.....	**337,848**
Nine months — 1946	244,201	957,999	615,343	488,316	818,211	959,091	.....	.....	4,083,161	249,246

Conditions Unfavorable...

Yet Duraplastic Gave Excellent Slip-Form Results



1,000-ton Debris Bin **(at left).** Concreting north third of Blending Bin **(above).** Robena Mine, H. C. Frick Coke Co., Uniontown, Pa. Engineers and Contractors: MacDonald Engineering Co., Chicago. Ready-mix concrete: McClain Sand and Gravel Co., Point Marion, Pa.

The weather did its best to make the job difficult. It rained frequently. Temperatures varied from 35° to very warm. Besides, much of the help was inexperienced.

In spite of these unfavorable circumstances, slip-form work on the Debris Bin progressed rapidly and smoothly. Because of the superior workability of Atlas Duraplastic concrete, contractor recommended and owner approved its use also for the 18,000-ton Blending Bin. Report showed: excellent-looking concrete with no honeycomb . . . good workability of concrete permitted placing around heavy reinforcing with less spading.

For slip-forms, as well as for other methods of construction, Duraplastic makes concrete more workable, more plastic and more uniform throughout. It provides the proper amount of entrained air needed for satisfactory field performance and complies with ASTM and Federal Specifications. It sells at the same price as regular cement.

Send for further information. Write Universal Atlas Cement Company, (United States Steel Corporation Subsidiary), Chrysler Building, New York 17, N. Y.

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ENR-D-55

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"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—ABC Network*

News of the Week

ENGINEERING NEWS-RECORD • OCTOBER 2, 1947 • VOLUME 139 • NUMBER 14

Highway officials advised to educate public on needs

Growing urgency of the need for better highway service to urban centers stressed at meeting of American Association of State Highway Officials.

If highway construction in the next few years is not to fall below the minimum required to meet this country's expanding economy, the public must be educated as to the magnitude of the task ahead and the urgency of a continuing program. Speakers at opening sessions of the annual meeting of the American Association of State Highway Officials, held in New York Sept. 22-26, repeatedly stressed that theme.

Governor Thomas E. Dewey of New York was the first to take up the subject in his address of welcome at the opening session. Later, like views were expressed by C. W. Phillips, president of the association, by Thomas H. MacDonald of the Public Roads Administration and Senator John S. Cooper, chairman of the Subcommittee on Public Roads of the new Senate Committee on Public Works.

Governor Dewey said that U. S. cities cannot continue to exist without adequate highways to serve them.

New York's road program

Turning to New York's road problems, he paid high tribute to Charles H. Sells, superintendent of the state's Department of Public Works and said that Mr. Sells had just submitted to him a report showing that the state must spend $2,000,000,000 on highways between now and 1960 if its highways are made adequate for the anticipated traffic. "This cost," he said, "is staggering. But failure to meet this challenge would be more staggering."

Senator Cooper also expressed the opinion that U. S. economy cannot continue to function without adequate highways, and added that an increased production of commodities is essential to national economic welfare, which means that our distribution system—of which highways form a major element—must continue to expand.

The senator urged his hearers to dramatize the deficiencies of highway systems to bring home to the public the urgency of a continuing program and to offset efforts to have highways classified as deferable public works. He said that it is imperative that a new program covering at least three years be presented to Congress at the next session. This might be set up as an extension of the present program.

President Phillips also recommended that early attention be given to a program of work to follow the current program, and he stressed the need for combating the efforts of pressure groups in the country to break the long-standing contractual relation between the states and the federal government for financing highway work. "We must take the public into our confidence and show it our problems," Mr. Phillips said. "Public sentiment is a powerful weapon. With it, we can work wonders; without it, we struggle in vain."

Good progress made

Much satisfaction with the progress now being made on work authorized by the Federal Aid Highway Act of 1944 was expressed by Thomas H. MacDonald. "Notwithstanding the shortage of critical materials, the disorganization of engineering and contracting forces and other limiting factors, the highway officials responsible for administration of the new legislation have made a magnificent record."

Turning to the record, Mr. MacDonald said that improvements have been programmed for about 15,000 miles, involving about $437,000,000 of federal funds or about 67 percent of the funds authorized under the 1944 act. "This relationship implies that the entire amount authorized will provide for the improvement of about 23,000 miles, or 10 percent of the mileage included in the federal-aid system. "It would seem that a faster rate is necessary if a program of economic replacement is to be followed."

Plans for 10,210 miles involving $278,000,000 of federal funds have been approved by PRA.

(*Continued on page 72*)

Discuss Highways—*Governor Thomas E. Dewey of New York (center) and Charles H. Sells (right) superintendent of that state's Department of Public Works, discuss future highway programs with C. W. Phillips, retiring president of the American Association of State Highway Officials.*

NEWS IN BRIEF

In telegraphic form, here are latest news developments on the engineering and construction front during the week.

Public Construction—Bids will be asked this month for the 200-bed general VA hospital in *Fort Wayne, Ind.* . . . A newspaper survey indicates that *Ohio* colleges and universities plan to spend more than $100,000,000 for construction in the next 10 years . . . *Lakeland, Fla.*, has voted a $600,000 bond issue for two new school buildings . . . The Department of Education, *Baltimore, Md.*, is planning to spend $29,000,000 for new school buildings . . . Ground has been broken in *Fall River, Mass.*, for a $187,000 airport on the site of the former Riverside Trotting Park . . . A $450,000 science building is planned for the Arizona State College at *Tempe*, bids to be opened Oct. 16 . . . I. O. Friswold, director of buildings and business administration for the *Minnesota* Department of Education, says the state's public school plant needs $100,000,000 of new construction.

Industrial Construction — Turner Construction Co. is to build a $2,000,000 industrial plant for the Associated Spring Corp. in *Forestville, Conn.* . . . More than $1,000,000,000 in construction is definitely planned in long-range highway, airport, and inland port terminal and waterway facilities in the *Chicago, Ill.*, area . . . The Board of Publication of the Methodist Church has authorized $2,000,000 of construction in *Nashville, Tenn.*, including a new office building . . . Excavation has started for the $3,000,000 Fisher Building at *Dallas, Tex.* The exterior will be of architectural aluminum. In the same city a $3,500,000 retail store building for Sears, Roebuck & Co. is finished. . . . A $4,000,000 industrial center will be built at *Newton Centre, Mass.*, in the next three years . . . A Sunshine Biscuit plant to cost $1,750,000 will be built in the Fairfax district of *Kansas City, Kan.* . . . Work may start this fall on the new power generating plant of the Illinois Power Co. in *Madison County, Ill.*

Housing—Security Mutual Life Ins. Co. has approved plans for a 200-unit housing project at *Vestal, N. Y.* . . . Temporary veterans' dwellings for *Minneapolis, Minn.*, and the University of Minnesota are expected to be completed by Christmas. The U. S. Public Housing Administration has authorized the Sherry Richards Co. of Chicago to proceed with the completion of 54 city and 206 university dwellings. The contract previously had been awarded to the Madsen Construction Co. of Minneapolis, but a shortage of government funds forced cancellation after construction had begun. At the last session of Congress, however, an appropriation of $35,500,000 was voted for the completion of the homes.

Water Supply and Sewers—The J. N. Pease engineering firm at Charlotte, N. C., is conducting preliminary surveys in connection with proposals to expand the water and sewerage systems at *Morganton, N. C.* . . . A questionnaire to consumers will be used to get public opinion regarding a proposed water filtration plant for *Marion, Ind.* . . . The Federal Works Agency has approved plans for a new sewer system at *Gulfport, Miss.* . . . *Winston-Salem, N. C.*, will vote on a water system improvement bond issue Nov. 4. . . . *Burlington, N. C.*, has voted $1,150,000 for water line improvements and extensions.

Miscellany—A $3,000,000 gas plant will be constructed at Silsbee Field, Hardin County, Tex., by the American Republics Corp. and the Houston Oil Co. . . . Bids for the construction of a tunnel, shaft and stope for exploratory foundation investigation at the site of the proposed Foster Creek Dam on the Columbia River in northeast *Washington State* will be called shortly. The work calls for enlarging 330 ft. of existing tunnel and constructing 690 ft. of new tunnel. . . . Construction of a 26-inch, $155,000,000 pipe line for natural gas, extending 1,800 miles from the gas fields of the Coastal Refineries and Rogers Lacy in *Hidalgo County, Tex.*, to New York City, is being planned by the Transcontinental Gas Pipe Line Co. . . . Bricklayers, Masons and Plasterers Union has reached an agreement with contractors in the *Hartford* and *New Britain, Conn.*, areas that grants a wage increase from $1.90 to $2.15 an hour. The union, an AFL member, will work a 40-hour week and the contract allows double for overtime. . . . The 53-day-old strike at the United States Gypsum Co. plant in *Sweetwater, Tex.*, continues to tie up the construction of about 5,000 homes in Texas.

Army approves bridge across Chesapeake Bay

The War Department last week announced it had approved construction of a bridge across Chesapeake Bay near Baltimore, Md., voicing no objections to engineering phases of the bridge project. The structure, for which engineering contracts were let recently (*ENR* Sep. 11, Vol. p. 357) would connect Baltimore with the eastern shore of Maryland.

Only War Department objections concerned the financing of the project.

Ohio seeks limitation on auto tax use

An amendment to the Ohio State Constitution to limit the use of the state gasoline and motor vehicle registration tax revenues to expenditures for street and highway purposes, will be submitted to voters at the Nov. 4 election.

Sponsored by the Ohio Committee for Better Roads and Streets, the amendment has been bitterly opposed by the Ohio Farm Bureau, the Real Estate Board and the State Education Association.

As a practical matter, the proposed amendment would affect only the $15,000,000 annual revenue from the liquid fuel tax, which at present goes to the State General Fund.

Institute to be created for earthquake research

Preliminary plans for an earthquake research institute have been formulated in San Francisco.

At a meeting of the Advisory Committee on Engineering Seismology to the U. S. Coast and Geodetic Survey, a sub-committee was set up to investigate the establishment of the institute. William J. Fox, chief engineer of the Los Angeles county department of building and safety, will act as chairman. Prof. R. R. Martel, head of the structural engineering department, California Institute of Technology; Samuel B. Morris, general manager and chief engineer of the Los Angeles Department of Water and Power, and H. C. Powers, representing the Structural Engineers Association of Northern California, will aid Mr. Fox.

With the Geodetic Survey already accumulating important seismic data, the institute is to be set up to furnish a practical analysis and interpretation of the information in a form readily available to engineers.

Attending the San Francisco meeting were technical representatives from 14 West Coast organizations. Cooperating with the committee during the conference were Captain O. W. Swainson, supervisor of the Western District, U. S. Coast and Geodetic Survey, and Franklin P. Ulrich, chief of the seismological field survey.

Rush national basic building code

In a further step toward adoption of the long-sought national building code, the Building Officials Conference of America last week announced that a basic code will be distributed in the near future to industry and building officials for study and recommendation.

Discussion of further steps toward adoption of the performance-standards code and a general review of building industry developments featured a five-day joint meeting of the BOCA and the new Building Officials Foundation at Columbus, Ohio, Sept. 21 to 25.

A board of consultants announced it had completed its recommendations on the basic code, and BOCA officials said that as soon as the revised draft of the basic code can be printed, copies will be distributed for comment and study.

Completion of the work of the consultants in itself marks a long forward step in the adoption of a national code, which, it is hoped, will go far toward regularizing building construction and bringing down construction costs. The code, as finally approved, would serve as a model for communities in revising and modernizing their individual building requirements.

Trace Foundation progress

The program and progress of the Building Officials Foundation, which was established in 1946 to promote the adoption of the national code, publish the results of tests of construction materials and techniques, and provide consulting services for local building departments (*ENR* Oct. 24, 1946, vol. p.556) was detailed in a symposium. Bernard A. Savage, acting director, discussed the policies and administration; George E. Strehan, basic code coordinator, told of technical phases, and Norbert Brown, public relations director, discussed publicity aspects of the BOF program.

The speakers pointed out that the BOF is completing plans for its administrative organization and arranging for initial financing by the industry. About $60,000 has been donated of an estimated $600,000 needed. Mr. Savage stressed that the amount that any single company can give to the initial fund is limited to a very small sum to enable as many organizations as possible to participate, although the construction industry as a whole will save considerable sums of money through the establishment of a single agency for testing and approving building products.

Senator Joseph R. McCarthy of Wisconsin, and Rep. Rolla C. McMillen of Illinois, members of a congressional committee investigating housing, told the assembled officials that a national building code will result in more homes at lower cost.

Senator McCarthy said his committee is out to cut costs by legislation "or otherwise", and stimulate production of homes. He blamed the "gray market" in industry for rising costs of building materials.

Other symposiums at the meeting dealt with building code defects, fire protection and prefabrication.

The BOCA re-elected James H. Mooney, chairman of the Board of Standards of the Massachusetts Department of Public Safety, as president; Albert H. Baum, building commissioner of St. Louis, Mo., as first vice-president; George H. Slenker, building inspector of Allentown, Pa., as secretary; H. E. Hagood, building inspector of Birmingham, Ala., second vice-president; Arthur N. Rutherford, building inspector of West Hartford, Conn., treasurer, and B. J. McKelvey, building inspector of Bridgeport, Conn., historian.

Erosion, groundwater research studies approved

Research on the mechanics of wind erosion and studies of methods of improving irrigation water supplies by recharging groundwater storage have been approved by the Department of Agriculture under authority of the Research and Marketing Act of 1946.

E. A. Meyer, administrator of the act, said last week that both projects have been assigned to the Soil Conservation Service. The wind erosion project will be carried out at the Kansas State Experiment Station, and the irrigation studies in California.

The wind erosion studies will include the development of basic information on the relationship between wind, soil, vegetative cover, and topography that is necessary for the design of preventive measures. Permanent wind tunnels will be built for analytical studies on the action of wind erosion, and small wind tunnels may be developed for field use.

The irrigation information is required to develop means of improving the subsurface water supply in areas where it is not sufficient to meet farming needs.

Army to test huge explosive charges

A series of tests designed to determine the destructive effects of explosive charges ranging up to 320,000 lb. of TNT against underground structures in various types of soil and rock, is being initiated by the Corps of Engineers.

The experiments will be conducted at Dugway Proving Grounds near Salt Lake City, Utah, and at other points in that vicinity.

The tests will be a continuation of experiments made before and during the war in which charges up to 2,000 lb. were used. The new program is designed to obtain information on heavier charges in keeping with the increased firing power of offensive weapons.

Target structures of a simple type will be used in the earth tests to establish the structural damage from earth under shock. The charges will be exploded at depths running from 7 to 70 ft., in accordance with their size. The targets will be placed at three distances from the charge in order to produce very heavy damage, moderate damage, and light damage, targets being constructed with neither tops nor bottoms but with the wall toward the explosion of much heavier construction than the side walls.

Underground plants tested

In addition to the simple target structures, there will be included representative types that might be built underground. These will include a heavy underground structure of the type that might be built for a Command Post and designed for protection against a direct hit or contact explosion of a 2,000-lb. bomb; a light underground shelter such as might be used for the protection of workers or for civilian defense, and in addition there will be a surface type structure of windowless construction that might be used to afford limited protection against the effects of the atomic bomb.

The program in rock will be somewhat different. Tunnels will be constructed at depths varying from 125 to 175 ft., and the TNT charges, set off overhead, will determine the protective qualities of the different types of rock.

The program for the tests was prepared by the Protective Construction Branch, Engineering Division, Military Construction, Office of the Chief of Engineers, with the assistance of a group of civilian consultants. These consultants include: Dr. Arthur Casagrande of the Graduate School of Engineering, Harvard University; and Professor John B. Wilbur, Acting Head of the Department of Structural and Sanitary Engineering, of M.I.T.

Urge public education on road needs

(*Continued from page 69*)

On the federal-aid secondary system, improvements on 32,000 miles involving $274,000,000 have been programmed and plans for 18,300 miles totaling $159,000,000 have received PRA approval.

Programs for 618 miles of work through cities costing $178,000,000, or about 50 percent of the available federal aid, have been prepared and the PRA has approved projects involving $79,000,000. (Details of the work under contract are given on p. 74.)

Mr. MacDonald said that in recent months the PRA has been holding back on approvals where delays in completing work under contract indicates that contractors are competing with each other for labor or materials.

Bridges and structures

Members of the bridges and structures committee and a large number of visitors spent a profitable three hours listening to papers by E. W. Wendell, deputy chief engineer, New York State Department of Public Works on bridge foundations and to L. Coff, consulting engineer, John A. Roebling's Sons Co., on prestressed concrete bridge design.

Urging increased attention to foundation design commensurate with its vital importance, Mr. Wendell used his own New York State procedures to point up the needs and the possibilities of structural support.

From a topographical layout of a proposed bridge site submitted by the district engineer to the central office at Albany, a preliminary study of the type of structure considered desirable is developed. After agreement on the structure is obtained from the district, borings are ordered taken at the indicated foundation locations. A careful record is kept of the number of blows on the test casing as well as the number of blows on the dry sampling spoon. Particular emphasis is placed on having uniform test equipment throughout the state so that there will be no variations in interpretation of data from this cause. Soil studies vary, but a screen analysis and determination of water content are two of the most common tests.

From the boring data, the central office makes two profiles, on both of which the substructure of the bridge is plotted. One profile shows the type of material, the other iso-resistance lines obtained from driving the test equipment. From these the elevations at which the load should be carried at each foundation is determined and plotted. The important thing, Mr. Wendell emphasized, is that once these elevations are fixed there is seldom any reason to change them.

Prestressed concrete

Prestressing of concrete, said Mr. Coff, is a procedure by which all of a concrete section instead of only that on one side of the neutral axis is made to carry load. The concrete is given a high compression by squeezing it between plates or fittings pulled toward one another by tension applied to the reinforcing steel. For some three years the Roebling company has been experimenting with a method of squeezing that utilizes steel cables. Anchored to the ends of a beam or girder the cables are stressed by jacks, the gages of which furnish an accurate measure of the amount of prestress.

R. H. BALDOCK
Elected president of AASHO

The Roebling experiments have progressed to a point that the company is able to offer designs of a large variety of bridge structures and spans. The method has also been used to prestress the top surface of a 14,000 sq. ft. factory floor slab, and a similar method has been perfected for constructing prestressed, jointless airplane runways. The slab procedure is patented, but structure prestressing is not. On the latter type jobs, however, the company is prepared to act as a consultant, and for the present will ask to do the actual prestressing on jobs where its wire and cable are used.

Urban problems discussed

A panel discussion of urban highway problems was opened by Robert Moses, construction coordinator for the city of New York, who gave an account of what has been accomplished and what is planned in the way of parkways and expressways in the five boroughs of New York and in Westchester County. Speaking of the Brooklyn-Battery Tunnel, which is being completed by the Triborough Bridge and Tunnel Authority of which he is chairman, Mr. Moses said that it should have been a bridge instead of a tunnel and that current plans are to build a bridge of 4,600 ft span and 237 ft. underclearance at the Narrows instead of a tunnel.

Essential factors to be considered in planning expressways to serve urban areas were outlined by B. D. Tallamy, chief engineer of the New York State Department of Public Works. In such planning, Mr. Tallamy said, it is necessary to recognize that few existing through routes can be widened; new routes must be built in most instances; they should not be developed by "blasting a new highway through the city to serve state traffic" as they must not disrupt the proper functioning of the city.

Traffic congestion increasing

Traffic congestion is getting worse at an alarming rate, according to J. A. Anderson, head of the Virginia Department of Highways. Traffic in Richmond increased 59 percent from 1945 to 1947 but traffic congestion increased 104 percent in the same period, and the worst is yet to come, he said. Motor vehicle dealers in Virginia are holding orders for 60,000 new cars.

Because of the high cost of highways through urban areas, Mr. Anderson said, it is obvious that physical improvements cannot be relied upon to do the job, especially in smaller communities with limited resources. "The American motorist is in for much more regulation in regard to both his movements and his parking. . . . If traffic congestion is to be licked, much better use than is now the case will have to be made of streets that now exist. Because the average American motorist detests regulation, an enormous educational job confronts the highway traffic engineers and urban planners."

Local cooperation

The importance of getting local civic groups into the planning at an early stage was stressed by Russell W. James, highway bridge engineer of the PRA at Denver, who cited the planning for the Valley Highway at Denver. There the Downtown Businessman's Association engaged the consulting engineers who had made the original studies for the highway for the state and city to design an extension to serve an industrial area that was deteriorating rapidly. Mr. James noted also that the city officials

"froze" all city owned property until it was known what route would be followed by the highway and held up building permits for sites that might be required, thus cutting the cost of right-of-way. Also, zoning has been changed to suit the new project.

In discussion, W. W. Zass, chief engineer of the Arkansas department, asked how parking and stalled vehicles are handled on New York expressways, to which Mr. Tallamy replied that their plans now provide an 8 ft. stopping lane for disabled vehicles. Parking on this lane may be permitted on some of the lesser arterial routes.

In reply to a question from A. M. Nash of California concerning provisions for mass transportation, which is a very live subject in the Los Angeles region, Mr. Tallamy said that provision for express bus traffic now is taken into consideration in all their planning.

D. C. Greer, state highway engineer of Texas, in the discussion of Mr. Tallamy's paper, gave support to the view that an early start must be made toward enlisting the support of city officials and civic groups if plans for highways through cities are to go ahead smoothly. There must also be a willingness on the part of highway officials to give as well as take when it comes to adjusting their planning to what the city officials think they need.

Prequalification of contractors

A paper by R. C. Keeling of Kansas on prequalification of contractors touched off a lively discussion that brought comments from representatives of many states. Most speakers emphasized that the effect of prequalification was to protect inexperienced contractors as well as keep the state out of trouble.

Most states qualify bidders as to the amount of work they can undertake at one time. Discussion centered around means for limiting the amount to be given one contractor at a single letting without keeping any one of those contractors from bidding on several jobs—on any or all of which they might be low. Texas holds lettings on successive days with selections of jobs in each such that contractors whose capacity to bid is limited by available equipment, financing or organization have a chance at additional jobs on the second day.

Connecticut permits bidders to put in proposals in a single letting on any number of jobs for which they are qualified. But, after a contractor is apparent low bidder on the total amount of work he is qualified to handle, his bids are not opened for additional work. Error in bid totals could cause trouble, but so far has not.

LEADERSHIP NEEDED

"Every element of leadership will be required to solve the Urban Highway Problem. The diplomacy of the statesman, the wisdom of the philosopher, and the optimism of the engineer should be applied with the enthusiasm of the child at play.

The victors of World War II are now either back with us, or preparing themselves in the schools and colleges of this nation to take their places among us. They are well acquainted with the miraculous and the impossible. We shall turn, and turn with confidence to the *young men* who will seek and conquer the problems in this post war world. Because the young veterans are determined to be a part of a better world, we shall have better urban highways"—*J. A. Anderson, Commissioner, Virginia Department of Highway, at the AASHO annual meeting.*

In other states, where bidding on all jobs for which a contractor is qualified is permitted, the usual procedure is to award work up to the limit of qualification of the bidder, but to reject his bid for additional work. This is done on the grounds that the contractor is not qualified for the additional work and then the award is made to the lowest *qualified* bidder.

In general, states using prequalification have found contractors cooperative and in favor of the procedure. Good contractors recognize their own limitations, so it is only the inexperienced or the hopeful type that require restraining by regulation.

High labor costs

Charles H. Sells, New York Superintendent of Public Works, said that out of every dollar spent on road construction, 50 cents is paid to labor directly employed in construction, while an additional 35 cents goes to labor that produces the material.

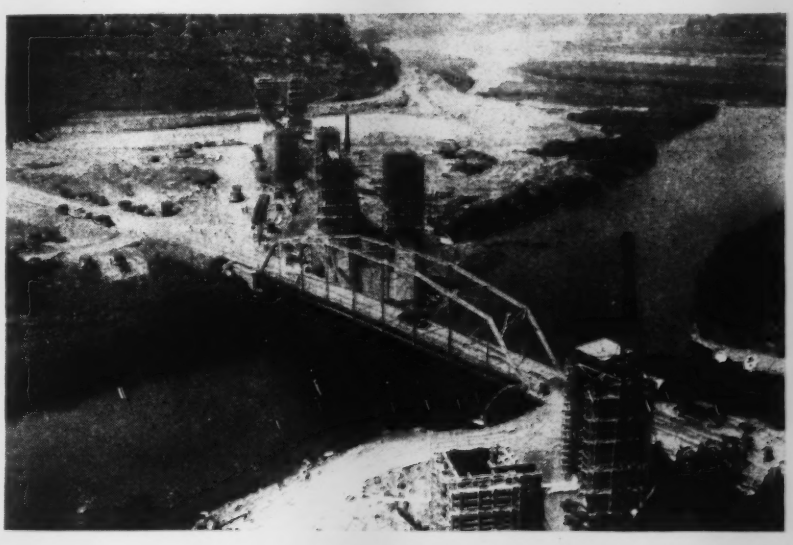
Relations with contractors

The committee on construction, under Chairman C. M. Hathaway of Illinois had some lively discussion on the relations of the eternal triangle of designers, construction engineers and contractors.

E. L. Merrill of the Maine highway commission, suggested a greater sense of humor and less arbitrary attitudes on the part of both engineers and contractors as a big help towards better jobs and greater economy.

Representing contractors, Dwight W. Winkelman, vice-president of the Associated General Contractors of America, pointed out that nine out of ten of the contractor's key personnel now are engineers and have an engineering approach to construction problems. He asked that highway departments be on the alert to take full

(*Continued on page 74*)



***Over The Top**—Because waters of the new Bluestone Reservoir will flood the existing roadway and bridge, the West Virginia highway department now has under construction the highest bridge in the state, on Route 20 in Summers County. The piers will be 145 ft. high, and will be part of a general relocation of the highway in the area. The contractor is the Dravo Corp., of Pittsburgh, Pa.*

advantage of new machines coming on the market by adjusting their designs and specifications to aid machine use.

In an open discussion of improving relations with contractors it was brought out that several states regularly ask contractor organizations for aid in revising specifications and for suggestions on more economical designs.

Preparation of construction cost estimates by engineers came in for considerable discussion, started with a formal paper by Robert E. O'Connor of Fort Wayne, Ind. Most of the points in the paper were quite ably seconded from the engineers side by a paper prepared by Bernard Atkin of the Illinois Division of Highways.

Shortages and long delivery periods for material are factors it is very difficult for engineers to evaluate, while shortages of labor add a definite and large percentage to job cost, but one that it is most difficult to put into a cash figure. Overtime to attract and keep men, reporting time on days when work cannot be done, travel allowance, difficulty of finding living quarters for followers of construction jobs, all are intangible factors that seriously affect contractors cost. Mr. Atkin suggested really free access to contractor's costs as an aid in preparing equitable engineer estimates with which to compare contractor's bids.

Effect of grades on capacity

The effect of grades on road capacity came up for active discussion in the design committee meeting where A. M. Nash of California suggested the need for a comprehensive study of the effect of mixed traffic on capacity by some such agency as the Highway Research Board. On this point, Earle V. Miller of Arizona said that his state is to make such a study this winter with PRA cooperation. Mr. Miller made the observation that passenger cars with trailers are just as bad as trucks when it come to slowing up traffic on very steep grades.

C. P. Owens, Missouri, reported that a study of safe passing distances for high-speed travel indicated that the cost of building a two-lane road with adequate sight distances for fast travel approaches the cost of building a four-lane road where such long sight distances are not needed because of the better provisions for passing.

Utilities along highways

Divergent views as to who should bear the cost of moving utilities developed in a joint meeting of the right-of-way and roadside development committees during discussion of a paper by Charles M. Noble, chief engineer of the New Jersey Highway Department, relating to utilities along limited-access highways.

When the New Jersey legislature passed the limited-access highway law in 1945, it specified that the highway department should bear the cost of moving utilities that had to be relocated. This, according to the comment on Mr. Noble's paper, is contrary to accepted practice and its advisability was questioned. Mr. Noble said that his department had no choice in the matter, but that in the end the public

(*Continued on p. 75*)

Progress reported on road program

Contracts awarded on federal-aid projects during the 20-month period from January 1, 1946, to August 31, 1947 amounted to $932,000,000 in total cost, Thomas H. MacDonald, head of the Public Roads Administration, told members of the American Association of State Highway Officials.

During the same period, the total cost of construction put in place in these and other projects under way at the beginning of the period amounted to $671,000,000. Thus, during the 20-month period, total contract awards on federal-aid projects exceed the total cost of construction work done by about $261,000,000, Mr. MacDonald said.

The awarding of contracts at a more rapid rate than construction was being completed resulted in a program of federal-aid projects under construction on Aug. 31, 1947, amounting to $817,000,000 total construction cost, of which projects let to contract between Jan. 1, 1946, and Aug. 31, 1947, amounted to over $766,000,000.

The total cost of projects under construction on June 30, 1947, was about $771,300,000, as compared to the $816,700,000 total indicated above for Aug. 31, and the June 30 total for projects let to contract after Jan. 1, 1946 was $717,774,926.

The Federal-aid Highway Act of 1944 and prior legislation provided for the financing of several classes of work in addition to construction—such as, highway planning, preliminary engineering, purchase of rights-of-way, and, under the Defense Highway Act, of advance engineering surveys and maintenance of access roads to sources of raw materials. The total program of federal-aid work under way or let to contract as of Aug. 31, 1947, included construction and other classes of work as follows:

Class of work	Total Cost	Percent of Total
Construction	$816,700,000	92.5
Highway planning	9,100,000	1.0
Preliminary engineering	27,100,000	3.1
Purchase of rights-of-way	16,100,000	1.8
Advance engineering surveys	13,400,000	1.5
Maintenance (access roads)	1,100,000	0.1
Total	**$883,500,000**	**100.0**

Work remaining to be done as of Aug. 31, 1947, on all projects under way or let to contract as of that date amounted to approximately $441,000,000, or about 50 percent of the $883,000,000 total program indicated above. Assuming equal rates of completion for the various classes of work included in the total program, the total construction work remaining to be done as of Aug. 31, 1947, on projects previously let to contract amounted to approximately $408,000,000.

In addition to the federal-aid program, highway contracts awarded on independent state work and on local work during the period from Jan. 1 through Aug. 31, 1947, totaled $176,800,000 and $126,600,000 respectively. (Data covering contract awards on independent state work are assembled by the Public Roads Administration, and on local contract awards by the Federal Works Agency from F. W. Dodge reports, *Engineering News-Record*, etc.) These state and local awards total $303,400,000 or about $100,000,000 less than contract awards on federal-aid work alone during the same period. Total contract awards on federal-aid, independent state and local highway construction projects during the 8-month period January through August, 1947, amounted to approximately $717,000,000.

The total cost of contracts awarded since Jan. 1, 1946, for federal-aid, state and local highway work amounts to $1,645,000,000, which is broken down as follows: federal-aid work, $932,400,000; state $405,800,000; local, $307,000,000.

Based upon the relationship between federal-aid-contract awards prior to Aug. 31, 1947, and construction work remaining to be done as of Aug. 31, 1947, the total federal-aid, state and local highway construction work under contract and remaining to be done as of Aug. 31, 1947, would amount to $720,000,000, as follows: federal-aid, $408,000,000; state, $178,000,000; local, $134,000,000.

The estimate of $720,000,000 of highway construction work under contract and remaining to be done as of Aug. 31, 1947, is not precise, Mr. MacDonald said.

pays, and his department takes the view that the part of the public most directly concerned—the motor vehicle users—should pay the cost.

Scour at bridge piers

Observations made and lessons learned concerning river scour in 50 years of engineering work on rivers was outlined by Gerard H. Matthes, consulting engineer of New York City. Among the more unusual of the observations was that on shallow rivers with granular beds scour at bridge piers and abutments may be as deep as four times the rise in a river during flood stage. For example, on the Platte River, a 1-ft. rise of water made some 3 to 4 ft. greater depth in some areas of the river. In the canyon where Hoover Dam is now located, a 50-ft. rise set in motion sand to a depth of 100 ft. below normal stream bed. Some railroads in the Great Plains states use a depth of possible scour of four times the rise as a criterion for design. This seems to have been adequate, where lesser precautions were not.

G. E. Shafer of Armco Drainage and Metal Products, Inc., outlined the criteria for design of flexible drainage structures under roadway fills. He pointed out that examination of a large number of culverts loaded in various ways showed that corrugated metal culverts under fills had deflected as much as 20 to 22 percent without failure but recommended design for 5 percent deflection.

Public relations

Thursday morning was given over to a panel discussion of public relation under the chairmanship of Spencer Miller, Jr., chairman of the New Jersey commission. Participating were H. S. Fairbank of the PRA, Charles H. Purcell, head of the California Department of Public Works, J. Stephen Walkins, head of the Kentucky Highway Commission, G. Donald Kennedy of the Automotive Safety Foundation, Norman G. Shidle, executive editor of the SAE Journal, and Kenneth Perry, general counsel of Johnson & Johnson, manufacturers of pharmaceutical supplies. The latter two represented highway users.

California's experience in gaining public acceptance of its plan for financing a large highway-building program was discussed at length. Mr. Purcell pointed to the value of having an outside engineering organization make an independent report on the highway department's program, and Mr. Kennedy, who prepared the outside study, said that the importance of what his staff prepared was that it was presented in a form easily understood by the layman. Mr. Kennedy added that a large reservoir of aid in developing support for highway programs will be found in organizations closely related to the highway field such as the automobile manufacturers, contractors, and trucking associations.

Citizens committees were cited as of great help in developing highway programs and in selling them to the public. Mr. Fairbank said that it should be remembered that good public relations are not an end but a means to an end, that of meeting the nation's highway needs satisfactorily.

In summing up, Mr. Miller observed that the matter of developing right relationships is the essence of the task before highway engineers and he pleaded for boldness in planning as the best way to stimulate interest and for insuring that the completed projects will be adequate for many years to come.

Bartlett award to Fairbank

A feature of the Tuesday morning meeting was presentation of the George S. Bartlett Award to H. S. Fairbank, deputy commissioner of the Public Roads Administration. The award is sponsored jointly by the Highway Research Board, the American Road Builders Association and the AASHO.

Presentation was made by Thomas H. MacDonald who said that no individual has contributed in larger measure than Mr. Fairbank to the work that lead to approval by Congress this year of the National System of Interstate Highways. In accepting the award, Mr. Fairbank said that he stood there only as a symbol of a large group of co-workers who had contributed honorably to the work.

At an earlier session, Fred R. White, chief engineer of the Iowa State Highway Department, presented the AASHO testimonial to M. J. Hoffman, head of the Minnesota Highway Department and a past president of the association.

New officers elected

R. H. Baldock, chief engineer of the Oregon Highway Department, was elected president at the closing session and Wesley W. Polk, chief highway engineer of the Illinois Division of Highways was advanced from regional vice president to first vice-president. New regional vice presidents are Wardner G. Scott, state engineer, Nebraska Department of Roads and Irrigation; and A. F. Winkler, chairman of the Montana Highway Commission.

Resolutions adopted at the business meeting included one petitioning Congress to authorize the expenditure of not less than $500,000,000 for federal-aid highway construction in the fiscal years 1949, 1950 and 1951 so that the current highway program can be continued in an orderly fashion. The Civil Aeronautics Board was asked to issue a regulation requiring airplanes to maintain a minimum clearance of at least 65 ft. over highways when taking off or landing, and the states were again urged to adopt the AASHO standards for maximum dimensions, weights and speeds of motor vehicles operating over their highways. The states also were requested to undertake the development of long-range plans for highway improvement and maintenance similar to that developed in California.

The Highway Research Board was asked to sponsor full-scale field bearing tests to reveal the weakening effect of freezing and thawing of road bases, subgrades and supporting soils.

U. S. begins lawsuit to clear memorial site

The Federal Government last week took steps to clear its legal rights to the site of the proposed $29,000,000 Jefferson National Memorial area on the St. Louis, Mo., river front south of the Eads Bridge.

In a suit filed in the U. S. District Court September 23, the government asked for declaratory judgment defining the government's rights and naming as defendants several local utility companies, all of which have conduits, cables, and pipes running in the memorial area. The petition alleges that the utilities have refused to recognize the government as the owner.

Meanwhile, judging of the entries submitted in a contest for design of the memorial began on September 23.

Canadian group to review Lachine Canal scheme

The Canadian Trans-port Ministry recently announced appointment of a new Board of Engineers to review the report of the 1926 boa.d on the Lachine Canal section of the proposed St. Lawrence deep waterway.

The Trans-port Ministry said that the new board will be called upon to determine whether the scheme proposed by the Joint Board of Engineers in its report of 1926 is still practical or "what alternative scheme, if any, would be better adapted to secure the ends desired." The new board has also been instructed to revise the costs of the 1926 recommendation. The Lachine Canal would be the principal part of the wholly Canadian section of the proposed St. Lawrence waterway.

HIGHLIGHTS OF MUNICIPAL DEVELOPMENTS

New York considers transit authority, bridge in harbor, sees early opening of mammoth airfield—Waco, Texas, to seek federal aid for new water supply dam—Boston plans incinerator

Juggling plans for a transit authority to operate the city's subway and surface transportation system, what would be the world's longest suspension bridge, and its new airport at Idlewild, New York City led municipal activities last week.

The transit authority—which presumably would be similar to that at Boston Mass. (*ENR* Sept. 11, vol.p. 359)—has been recommended to Mayor William O'Dwyer for the three-fold purpose of relieving the city of the burden of some $1,155,000,000 in debt on the transit system and year-to-year deficits on subway operations; making possible the construction of a new subway on Second Avenue; and releasing the city's borrowing capacity for use to provide needed construction and for cost-of-living pay increases and the like.

Such an authority would also have the right (with legislative approval) to raise the present five-cent fare to a sustaining rate.

Meanwhile, Parks Commissioner Robert Moses, in his added capacity of Construction Coordinator, revived a 40-year-old dream of a bridge or tunnel connecting the city's Borough of Richmond (Staten Island) with Brooklyn, across the Narrows which form the entrance to Upper New York Bay.

Opposed by armed forces

Long frowned upon by War and Navy departments as a possible menace to communications with the Brooklyn Navy Yard, upstream of The Narrows, in time of war, the project was first proposed in 1907. Staten Island residents, citizens of New York City, cannot reach the rest of the city except by ferry, although the island is tied to the New Jersey mainland by three bridges and numerous ferry routes.

Mr. Moses said he believed a bridge would be approved, in view of the recent approval of a bridge across Chesapeake Bay at Baltimore. If built, the bridge would have a 4,600-ft. channel span, which would make it the longest suspension span in the world by some 400 ft.

And the Port of New York Authority, which recently took over operations of New York's three major airports, announced that huge Idlewild Airport is expected to be in "good operating condition" by next spring, when six main runways on the 6,000-acre field will be ready for use. The authority said it planned to shift all international flights from the present terminus at LaGuardia Field to Idlewild by July 1, 1948.

County building code

Lucas County, (Toledo) Ohio, commissioners last week were considering a first draft of a building code that would govern all construction outside of the Toledo city limits.

Prepared by the consulting engineering firm of Charles Hatch and Associates, the code follows the lines of the Toledo city code, so that contractors working primarily in the city could meet requirements in outside areas. Like several other codes adopted recently, it contains "self adjusting" provisions to enable automatic changes when recommendations of national building and insurance groups admit new materials or techniques.

It also provides for the appointment of a county building inspector and an inspection staff.

Seek money for dam

Congress will be asked to appropriate funds for construction of a new dam and reservoir on the Bosque River to supersede Lake Waco as principal water supply for the city of Waco, Texas, officials said last week.

The new dam would be three miles long, built below the Lake Waco site, and its lake would flood the present reservoir completely. Engineers have estimated that Lake Waco's capacity will be insufficient by 1955, because the lake bed has filled with silt.

Incinerator plans

The city of Boston, Mass., brought suit against its own Board of Appeals to compel a reversal of a recent decision so that it may build an incinerator in the Brighton section. The incinerator would be practically smokeless and odorless, and would reduce a long truck haul to a city dump, officials said. The appeals board had turned down the proposal on the ground of a zoning violation, but commissioners split 3 to 2 in voting against the proposition. A unanimous vote is required by law.

At Indianapolis, Ind., the City Sanitation Commission proposed construction of a $1,000,000 incinerator and garage.

Steel company plans huge mine construction work

The Jones & Laughlin Steel Corporation of Pittsburgh, Pa., last week announced a huge consolidation and construction program involving its Vesta No. 4 and 5 coal mines at Richeyville and Vestaburg, Pa.

The work will include construction of connecting underground haulageways between the two mines; the installation of machinery to handle and dump cars; construction of a bridge across the Monongahela River, and a new harbor with barge handling equipment, ice breakers and other facilities; dredging of the river to open a channel to the harbor and the main coal washing plant, and construction of a coal washing plant with a capacity of 26,000 tons daily that will separate the coal from refuse and separate the better coals of low specific gravity from lower grade coals. The principal engineering contract has been awarded to F. H. McGraw Co., Hartford, Conn.

Ben Moreell, president and board chairman of Jones & Laughlin, said the program will require eighteen months to two years to complete, and will mean that the consolidated mine will be equipped to produce 18,000 tons of washed coal per day.

Argentina lists orders of hydro project work

The report of our Argentine correspondent (*ENR* Sept. 11, 1947) regarding that country's five-year development plan—in which over-enthusiasm in the initial announcements, slowness of the program to date, etc., were emphasized—is accorded agreement by an American engineer close to the program, but he points out that the "Salta Grande" hydro project was not, as stated, "the first job scheduled for construction." On the contrary, it has from the beginning been recognized as more of a long-range hope than a possibility, not only because of its size, but because Uruguay's cooperation has to be secured.

Actually the first year program for hydro electric projects, announced in April, 1947, included 13 jobs totaling about 240,000 kw. One was of 70,000 kw. size, another of 62,000, while the remainder were of 20,000 kw. or less. Bids have been received on the first project, a 16,000 kw. project on the Rio III, in the province of Cordoba, and bids for the second project, a 5,000 kw. plant known as "Ing. Cipolletti" in Rio Negro province, will be asked soon. Beyond this, the program has not progressed toward actual construction.

OBITUARY

John Mason Young, 73, president of the Pacific Engineering Co. and emeritus professor of engineering, University of Hawaii, died in Honolulu, Aug. 29. A graduate of the University of Florida in science and of Cornell University in engineering, he had been connected with engineering work in New York City, then moved to Hawaii. He was the first professor of engineering in the original College of Hawaii. For 31 years he was connected with the college, and later the University of Hawaii, retiring in 1940. He planned and supervised the construction of many structures in the Territory of Hawaii and was a member of many public commissions during his long residence in the Islands.

Harold M. Barton, 64, for 33 years an engineer with the Geodetic Survey branch of Canada's Department of Mines and Resources, died at Ottawa Sept. 15. A native of England and graduate of an English university, Mr. Barton went to Canada in 1909 when he joined the Department.

John P. Grace, 42, Lindenwood, N. J., a construction engineer, died recently in Camden.

A. G. Roy, 71, Lewiston, Me., highway construction expert and head of the Lewiston Public Works Department for 40 years, died Sept. 16. He retired about a year ago.

Leroy V. Workman, an engineer with the Federal Works Agency and U. S. Public Roads Administration, Harrisburg, Pa., died Sept. 20. He was a graduate of Pennsylvania State College.

G. J. Adamson, 67, engineering assistant to the vice-president of the Union Pacific Railroad, died in Omaha, Neb., Sept. 23. He began his railroad career in Omaha in 1905 and was a key man in the planning of the $2,600,000 retarder yard now under construction at Pocatello, Idaho.

A. P. Dean named to head Forest Service engineers

Anthony P. Dean, since 1939 assistant regional forester in charge of engineering for the California National Forests, with headquarters at San Francisco, will become chief of engineering division for U. S. Dept. of Agriculture's Forest Service in January, 1948.

Mr. Dean will succeed Theodore W. Norcross, who has been chief of the engineering division since 1920, and is now retiring. James J. Byrne, now with the Pacific Northwest Forest Experiment Station at Portland, Ore., will take over Mr. Dean's former assignment.

A native of Medford, Mass., Mr. Norcross was graduated at Tufts College in 1904 as a civil engineer and joined the Forest Service following several years of experience in hydrologic work with the U. S. Geological Survey and the City of Springfield, Mass. His first Forest Service assignment was regional engineer with headquarters at Denver, Colo. In 1913 he became assistant chief engineer and became chief engineer seven years later.

Canada ends all controls on construction industry

Effective this month, the Canadian construction industry was operating in a completely free atmosphere, after the Canadian wartime prices and trade board ordered the removal of all remaining controls.

These remaining controls applied principally to materials in short supply, nails, plywoods, millwork and soil pipe. The Board said that supplies of these materials warrant the removal of restrictions.

Export controls, however, will remain on lumber, since this material is still considered to be in critical supply an announcement said.

MAJOR MEETINGS

American Public Works Association annual Public Works Congress, Hotel George Washington, Jacksonville, Fla., Oct. 5-8.

Canadian Institute on Sewage and Sanitation, annual convention, General Brock Hotel, Niagara Falls, Ont., Oct. 6-8.

National Safety Council, annual convention, Stevens Hotel, Chicago, Ill., Oct. 6-10.

American Society of Civil Engineers, fall meeting, Roosevelt Hotel, Jacksonville, Fla., Oct. 13-17.

National Metal Congress and Exposition, Palmer House, Chicago, Ill., Oct. 18-19.

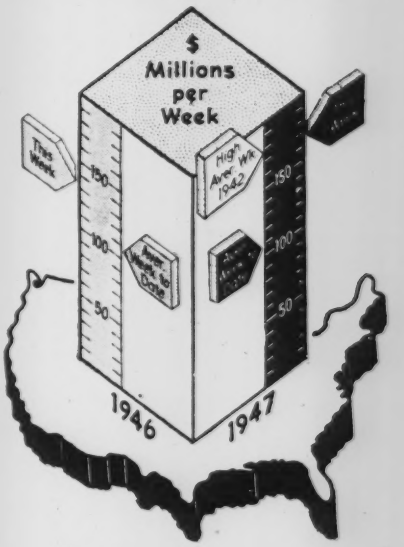
American Welding Society, annual meeting, Sherman Hotel, Chicago, Ill., Oct. 20-24.

Engineers' Council for Professional Development, 15th annual meeting, Mount Royal Hotel, Montreal, Canada, Oct. 24-25.

National Council of State Board of Engineering Examiners, 26th annual meeting, Hotel Pennsylvania, New York, N. Y., Oct. 27-29.

American Institute of Steel Construction, 25th annual convention, Roney Plaza Hotel, Miami Beach, Fla., Nov. 10-13.

CONSTRUCTION ACTIVITY



As Reported this week to...
Engineering News-Record

CONTRACT VOLUME

Continental U. S. Only (Thousands of Dollars)

	Week of Oct. 2 1947	Cumulative 1947 (40 wks.)	Cumulative 1946 (40 wks.)
Federal	$12,008	$505,122	$524,367
State & Mun.	24,563	1,317,538	1,134,066
Total Public	$36,571	$1,822,660	$1,658,433
Total Private	130,241	2,450,554	2,534,183
U. S. Total	**$166,812**	**$4,273,214**	**$4,192,616**

WHERE CONSTRUCTION ACTIVITY ORIGINATED THIS WEEK

Dollar Volume (Thousands)

Type of Work	This Week	Cumulative 1947 (40 wks.)	Cumulative 1946 (40 wks.)
Waterworks	$828	$83,002	$89,232
Sewerage	1,458	105,421	88,372
Bridges	4,269	136,633	107,022
Highways	10,249	619,976	621,154
Earthwork, Waterways	7,058	238,262	289,367
Buildings, Public	10,914	440,999	331,261
Industrial	32,425	683,966	805,357
Commercial	83,055	1,426,754	1,561,713
Unclassified	16,556	538,201	299,198

NOTE: Minimum size projects included are: Waterworks and waterway projects, $22,500; other public works, $40,000; industrial buildings, $55,000; other buildings, $205,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1947 (40 wks.)	Cumulative 1946 (40 wks.)
NON-FEDERAL	1,798,717	$1,226,071
Corporate Securities	632,759	357,098
State and Municipal	918,247	643,973
Fed. Aid Highway	247,711	225,000
FEDERAL	818,729	1,714,695
Total Capital	**$2,617,446**	**$2,940,766**

ENR INDEX NUMBERS

Index Base = 100		1913	1926
Construction Cost	Sept. '47	417.81	206.84
Building Cost	Sept. '47	317.08	171.40
Volume	Aug. '47	215	94

EDITORIALS

VOLUME 139 NUMBER 14

October 2, 1947

Support for Highway Program

THE PUBLIC must be educated as to the need for a continuing and costly highway-building program. Otherwise, an inadequate transportation system will strangle the nation's economy. That is the message that stands out from the talks made at the general sessions of the annual meeting of the American Association of State Highway Officials in New York last week. In varied phraseology it came from so diverse a group of speakers as Governor Dewey of New York; Senator Cooper, chairman of the Senate Subcommittee on Roads; Thomas H. MacDonald, head of the Public Roads Administration, and C. W. Phillips, president of the association. Every day the cumulative effect of the curtailment of roadbuilding during the war and the preceding depression becomes more evident, especially around our cities. Governor Dewey characterized the cost of this work as staggering, but added that the effect of *not doing it* would be even more staggering. This is the aspect that must be brought home forcefully to the general public.

Twilight Zone Projects

A NICE EXAMPLE of how a special authority can function in situations where private interests and existing governmental agencies are unable to operate is revealed by the Port of New York Authority proposal for rehabilitating the Hoboken, N. J., piers. As reported in last week's issue (vol. p. 432) the authority would undertake a $17,000,000 improvement program, the net revenue from which is estimated to be $71,000 annually; of this amount Hoboken would be guaranteed a return of $50,000, plus 75 percent of the revenue in excess of that amount. Although the "profit" to the authority on such a deal seems pitifully small, this is exactly why the authority considers it an ideal operation to come under its direction. This return is too small to attract risk capital in private hands and therefore the project under the authority's direction would in no way infringe on private enterprise. And neither the municipality of Hoboken nor the federal government, which has operated the piers since 1918 at a loss, are in a position to make expenditures for improvements from public funds. In this twilight zone, where both private and governmental agencies find it inexpedient to undertake vitally needed improvements, the special authority as an instrumentality for public service offers the way out of a dilemma. What happens to the Port Authority's Hoboken proposal, therefore, will be of wide interest.

Model Code Should Be Functional

IN VIEW of the pressing need of many communities to modernize their building laws, the efforts of the Building Officials' Conference of America to rush promulgation of a model national code are to be commended. Yet there seems to be a danger that the inevitable compromises in its drafting may make it less of a functional code than was first planned. This is regettable. It is obviously desirable that the basic code be written so that legislative bodies—state or local—should seldom, if ever, be called upon to revise it. This objective can be achieved only if it is purely a functional or performance-standards code. If it should prove not to be functional, it is difficult to understand why the BOCA code rather than some other well-seasoned code should be the national model. When given an opportunity to examine the BOCA basic code, the construction industry should strongly criticize every non-functional provision it contains.

Field Help for Office Forces

THERE ARE MANY new and useful ideas in field construction that could be translated into design economies if detailers, designers, and specification writers were more often given opportunities to visit jobs in the field. The top men of design organization visit field jobs regularly, but for different purposes than to study the small details. At the recent meeting of the American Association of State Highway Officials, Dwight W. Winkleman, vice president of the Associated General Contractors of America, invited those who draw plans and write specifications to visit going jobs "where they can observe at first hand the operations of a contractor and become familiar with the operation of new equipment". Now, when next year's plans and specifications are in the making, the suggestion has special merit. A most important part of such a visit, in addition to observing details of the work, is to get the viewpoint of the contractor's supervisory personnel. Each of these men has valuable ideas for those who specify details.

Face the Facts

THEORIES AND FACTS are getting badly mixed in discussion of the current proposal to raise the dues of members of the American Society of Civil Engineers. Most opposition to the increase finds its origin in a belief that recent expansions of ASCE activities have been in a field that more appropriately could be occupied by the National Society of Professional Engineers. And, although the relation of the NSPE to the ASCE and the other Founder Societies is a thorny subject, it, nevertheless, ought to be discussed openly and frankly if engineers are to retain the progress already made toward having a larger voice in national matters.

The first fact to be faced is that the ASCE and other Founder Societies are not exclusively scientific societies. Professional improvement of its members has been one of the stated objectives of the ASCE for over 25 years. In the early years of the society, professional activities were limited chiefly to matters relating to codes of ethics and practice and to fees for professional services. But for more than 20 years the society has been active in fields that now are within the scope of the NSPE. Outstanding early examples are work on registration laws for engineers and participation in national matters through the now defunct American Engineering Council.

The second fact to be faced is that the ASCE has built up a prestige that results in government officials turning to it for action and advice, which certainly its members would not have it refuse. The NSPE has yet to build up that type of national recognition.

Still another fact is that when it comes to speaking for engineers generally on national matters the Founder Societies, acting through Engineers Joint Council as they do now, are much more *national* in character than is the National Society of Professional Engineers, which has 16,000 members as compared to 21,000 in the ASCE alone. Moreover, to date, less than half the states have representation in the NSPE. This is not the fault of the NSPE; it is due primarily to the organization's youth and to slow acceptance of it as a national spokesman for engineers.

Building acceptance is the biggest problem faced by the men who today are earnestly endeavoring to build the NSPE to the point where it will be truly national in character. No one knows whether they have set themselves an impossible task. But even if they have not, the development process will be slow, and it would appear that success will be found through small beginnings on matters not within the scope of the Engineers Joint Council and through cooperation with EJC.

A beginning already has been made in the latter direction through appointment of NSPE representatives on the EJC Committee on the Economic Status of the Engineer. Also, there are matters such as salaries and classification of engineering positions on which the NSPE could work to advantage in close cooperation with the ASCE, not at cross purposes. This is a field which the state societies of professional engineers ultimately should take over exclusively, but the pioneering work of the ASCE in that field should not be scrapped or lost. It alone of the Founder Societies had the courage to tackle such a hot subject and carry its study through to the point of setting definite schedules of compensation.

Meanwhile, those who would have the ASCE sharply curtail its activities outside scientific fields should face the fact that the NSPE is not in a position to take over if it should; also that even if the ASCE board should decide to close its Washington office and withdraw its support from the Engineers Joint Council, that would be no guarantee that the boards of the other powerful societies that now are backing the council would do likewise.

The voice of engineers in national affairs will be definitely weakened by attempting at this stage to get one or all of the Founder Societies to drop what they are doing in that field on the theory that it can be picked up by the NSPE. Rather, the National Society of Professional Engineers should be made a full member of the Engineers Joint Council, and it should be encouraged in its efforts to organize affiliated state societies of professional engineers where none now exists. As the coordinating organization for the state societies it has a large field open to it, especially in matters affecting license laws, civil service regulations and the compensation of engineers. As it grows in numbers and in prestige the natural trend will be to look to it for leadership in more and more professional and legislative matters. Meanwhile, there should be no conflict between it and the Founder Societies.

ENGINEERING NEWS-RECORD
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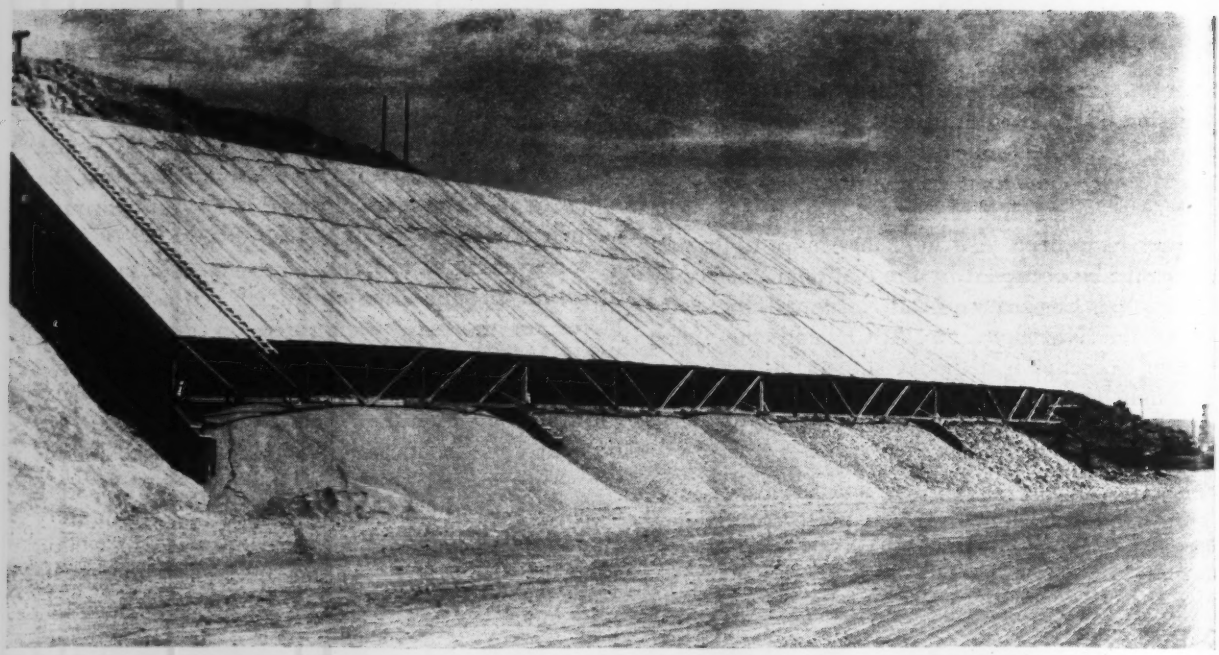


Wooden shed will protect 1,000 cu.yd. each of four aggregate sizes from the intense heat of the desert sun.

Shade-Shed For Cool Aggregate

TO PROTECT concrete aggregate from the intense heat of the desert sun at Davis Dam on the Colorado River, the Utah Construction Co. erected a wooden shed over their stockpiles. Specifications require that the aggregate be only 80 deg. F. when used for concrete. Because temperatures in the valley floor along this section of the Colorado River are regularly over 100 deg. during the long summer season, a cooling system is mandatory. By erecting a shading device the Utah Construction Co. hopes to reduce to some extent the amount of ice required to cool the aggregate.

Partitions made of 2-in. planking on 12x12 posts were constructed to separate the various sizes of aggregate at Davis Dam and also to support a shed-type roof.

The shed is built on a rock sidehill and has four separate compartments for the various sizes of aggregate. Each compartment can hold 1,000 cu.yd. of aggregate. Trucks deliver aggregate on a road which runs along the top of the stockpile arrangement. A tunnel underneath houses a rubber conveyor belt which takes the aggregate to the concrete batching plant. Sand is kept in an adjoining stockpile and not protected by the shed as the insulating qualities of sand will prevent the heat of the desert sun from penetrating to any great extent.

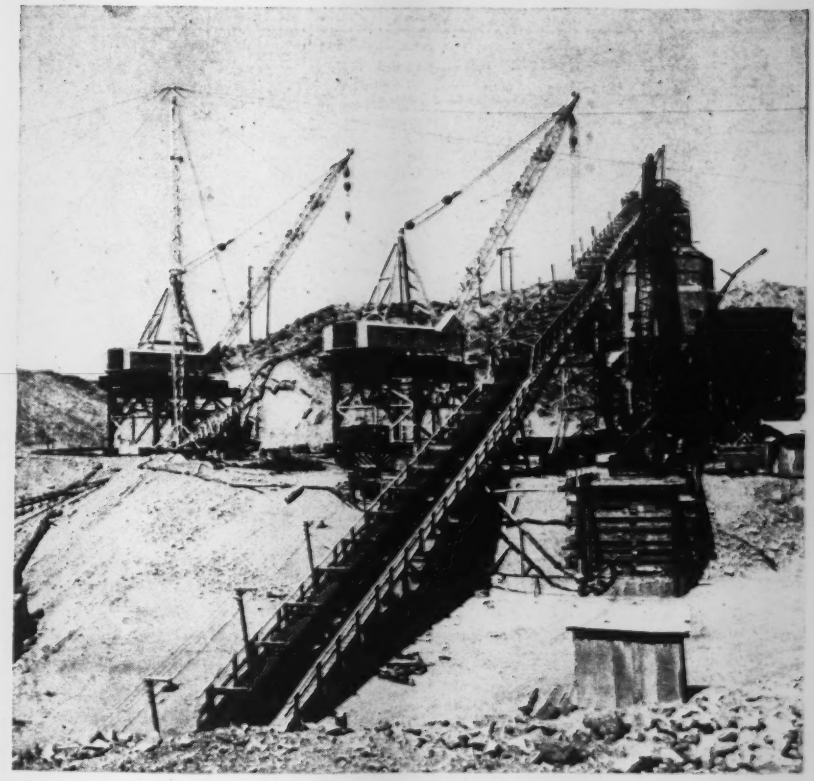
Although the dam is to be a 4,000,000-cu.yd. earth and rock fill, construction of the power plant, intake structure, spillway etc., will require more than a half million cubic yards of concrete. Consequently, extensive concrete mixing, batching, and placing facilities are being in-

stalled. The concrete batching plant is a veteran of construction at Fontana Dam, one of the TVA's major works.

These facilities are located on the Arizona side of the Colorado River just below the diversion and forebay channel. Aggregate is produced from natural deposits located on the Nevada side some three miles to the south. A subcontractor is in charge of this work and the Utah Construction Co. will pick up the aggregate at his plant and deliver it to the aggregate stockpile. A supply of 1,000 cu.yd. will be kept in each of the four compartments during construction work.

Vertical partitions, 50-ft. on center, consist of 12x12-in. posts set 4 to 6 ft. apart and sheathed on one side with 2-in. planking. Below a depth of 10 ft. of gravel, the sheathing is of double thickness. The partitions are anchored in place by ¾-in. tie-rods which are set in the top of the tunnel, halfway between the partitions. The tunnel is made of laminated timber construction by use of 2x12 planks on edge.

The 1-in. roof sheathing is supported on Pratt trusses spaced 3 ft. on centers. The trusses have 2x8-in. top and bottom chord members and 2x4-in. diagonals. This roof structure also protects the gravel from rain and permits better moisture control.



Concrete batching plant which is connected to the aggregate stockpile by means of a conveyor belt installation.

H. E. Williams is project manager for the Utah Construction Co. in general charge of this work, and T. L. Terry is general superintendent.

Large Cities Are Financing Transit Improvements

The Municipal Finance Officers Association reports that Chicago and Boston transit lines are being purchased from private owners by public agencies created expressly to refinance and rejuvenate metropolitan transit service.

In San Francisco, a $20 million bond issue to finance transit improvements will be voted on this fall. Cleveland officials are studying ways to finance a $22 million transit improvement program after efforts to float a bond issue failed. Transit systems in both cities are municipally-owned.

Fares on Seattle's city-owned transit lines were increased recently from eight-and-one-third to 10 cents to finance improvements and to cover increased operating costs. Philadelphia increased fare on its city-owned transit system from 8 to 10 cents.

Chicago's streetcar fare was increased from eight to nine cents last spring and another boost is contemplated when the Chicago Transit Authority takes over this fall. The privately-owned Washington, D. C. system was granted a fare-increase of from $1.25 to $1.50 for weekly passes.

To help pay inflated costs of operation, the St. Louis transit system, also privately-owned, started charging 25 cents more for weekly passes early this month. Fare-increase proposals are being studied in Cleveland, New York, Tacoma, and other cities.

Purchase of Chicago streetcar and elevated lines by the newly-created Chicago Transit Authority marks the biggest transaction of its kind in recent years. A $105 million bond sale will be used to put the lines under public ownership and to start a thorough modernization program.

Transit improvement in Boston is being undertaken by the Metropolitan Transit Authority, created by the 1947 Massachusetts legislature. A $23 million bond issue will enable complete transfer of Boston transit lines from private to public ownership. Boston and 13 surrounding municipalities are involved in the new authority created to provide unified transit service for the entire area.

Among the 14 U. S. cities with over 500,000 population, seven now own or are about to own their transit systems—Boston, Chicago, Cleveland, Detroit, Philadelphia, New York and San Francisco. Detroit, New York, Cleveland and San Francisco have municipally-owned and -operated bus lines.

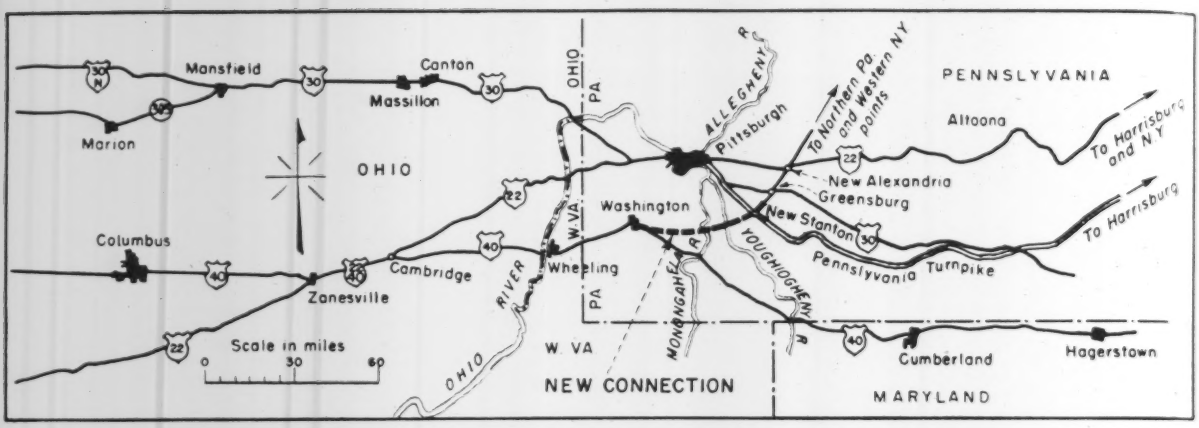


Fig. 1. The New Stanton-Washington, Pa., highway will carry traffic from Southern Ohio and the west around Pittsburgh.

Superhighway to By-pass Pittsburgh

John R. Dietz
Chief of the Highway Division
Gannett Fleming Corddry and Carpenter, Inc.
Harrisburg, Pa.

Contents in Brief: *A superhighway is planned and now partly under construction to connect the west, via U. S. Route 40 and 22, with the Pennsylvania Turnpike, passing south of Pittsburgh. The toll-free, divided 4-lane highway crosses major mountains with a maximum grade of 3 percent and only 38 curves in its 38-mile length. Design was done by Gannett Fleming Corddry and Carpenter, Inc. for the Pennsylvania Department of Highways, which is supervising the construction. Construction estimated at $23,000,000 still remains to be let.*

In July 1946, ground was broken on the first section of a 38-mile, 4-lane road between New Stanton, and Washington, Pennsylvania, which provides a high speed, easy grade connection from U.S. Route 40 to three main East-West roads across Pennsylvania. The general direction of this connection is east-west, the actual line appearing as a long radius arc sweeping south of a straight line between these terminals. This general swing to the south is necessary to provide favorable crossings of the two major rivers that traverse this section of Pennsylvania, the Monongahela and Youghiogheny.

The survey and design of this $25,000,000 road was turned over to a consulting engineering organization so as to have the plans ready for building during the immediate post-war period.

A glance at a highway map of Ohio, West Virginia and Pennsylvania, Fig. 1, will impress one with the importance of this road. The first, and most obvious, conclusion is that the connection provides a by-pass for east-west traffic to the south of Pittsburgh. However, as one reflects further on the highway pattern to the west, through West Virginia and Ohio, it becomes apparent that this connection is more of a primary route for east and west traffic and should be thought of in that light, rather than as a local by-pass of the Pittsburgh area. Route 40 (the National Pike) runs practically due east and west across Ohio and continues so to Washington, Pa. This proposed connection is almost a straight continuation of the general direction of Route 40 and will carry traffic from three main highways to Route 40.

At Washington, Pa., Route 40 takes a decided dip to the southeast through a rugged section of the Alleghenies and continues its eastward direction across the state of Maryland. It will be noted that U.S. Route 22 (the William Penn Highway) is common with Route 40 from Zanesville to Cambridge, Ohio. The general direction of Route 22 is north of east across Ohio from Cincinnati, to Pittsburgh. Thus, traffic traveling Route 22 with a destination east of Pittsburgh, will probably continue on Route 40 at Cambridge, Ohio, and take advantage of this new route to get east of Pittsburgh. The same will apply in case of traffic from the west bound for northern Pennsylvania or western New York.

Toll-free highway

The general route and important interchanges of the road are shown in Fig. 2.

The highway will be toll free and will not be of limited access as is the turnpike. However, every effort has been made—within the scope of sound engineering, economics and existing laws—to eliminate as much cross traffic as possible and to control traffic entering and leaving the high-

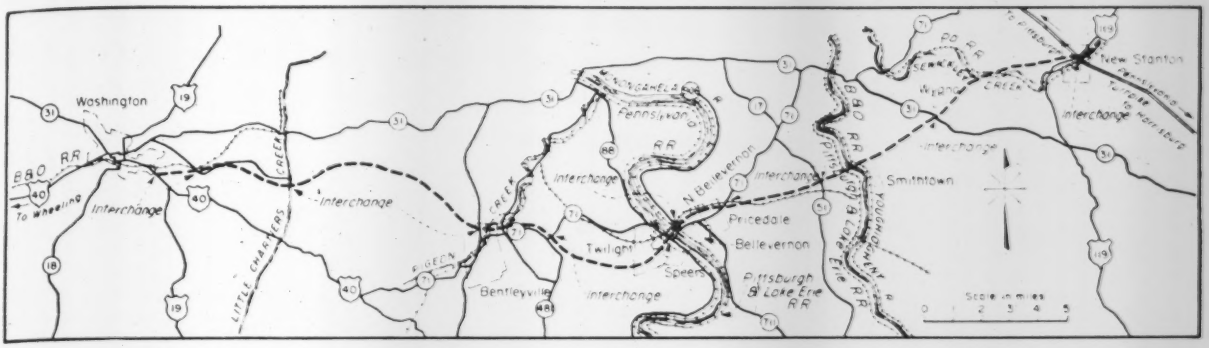


Fig. 2. There are twelve interchanges and several important stream, rail and road crossings on the new 38-mile highway.

way so as to present the least possible hazard to the high speed through traffic.

Intersecting highways of any importance have been separated to prevent cross-traffic on the main highway. At all but two of these separations, interchange ramps have been provided. Less important roads, consisting mostly of township earth roads and a few of the light traffic state highway rural routes intersect at grade. In the built-up areas marginal roads have been used extensively to serve local traffic and to reduce the number of crossings on the main line.

The number of interchanges led to considerably more structural work than is normally encountered on highways traversing such open country. At least seventeen highway separation structures will be needed in addition to the two major river crossings. The designs of these structures vary to fit conditions and include reinforced concrete T-beams, incased I-beams, reinforced concrete rigid frames, deck plate girders, through plate girders and deck trusses.

The more important of these structures are as follows:

About three miles west of New Stanton, the line crosses Sewickley Creek and a branch of the Pennsylvania R.R. This required a six-span structure 413 ft. long. The structure consists of deck plate girders continuous over the three stream spans and the western approach span. A concrete T-beam span over the railroad and a steel I-beam approach span complete the structure.

At the Youghiogheny River crossing the terrain is quite rugged, the west bank rising rather precipitously to 208 ft. above the stream bed. The structure at this location is 160 ft. above stream bed and has an overall length of 1,348 ft. It consists of three continuous deck truss spans over the river and railroads with three simple deck truss spans over the less precipitous east bank. A single I-beam approach span has been used on the west approach while a single deck plate girder span completes the eastern approach.

In the village of Pricedale, a viaduct is to be constructed over a township road, a creek, a railroad and a state highway. This structure is 397 ft. long and consists of three continuous deck plate girder spans with three simple I-beam approach spans.

Monongahela River crossing

The largest structure on the project is that crossing the Monongahela River, which will have an overall length of 2,130 ft. This will be a Cape Cod type steel arch with a main span of 450 ft. over the navigable channel, flanked by symmetrical through truss anchor spans of 210 ft. Deck truss and deck plate girder spans comprise the approaches.

In Bentleyville a 369-ft. structure is required to cross a relocation of the Pennsylvania R.R., Pigeon Creek and an interchange ramp. Simple deck plate girders are used over four spans with a single I-beam approach span on the east side. A 200 ft. spiral curve falls within the limits of this structure.

To the motorist driving the highway, it will not seem greatly different from the turnpike, the main difference being the use of a 4-ft. wide raised concrete center divisor in place of the 10-ft. earth divisor of the turnpike. The pavement will be 9 in. uniform depth reinforced concrete. Two 12 ft. traffic lanes with 10 ft. earth berms are provided on each side of the divisor. The number of lanes and the width of the berms are increased at all interchanges to meet conditions of traffic, clear sight distance and landscaping.

In general, slopes of 1½:1 or flatter have been used in both cuts and embankments. All cuts of any magnitude were drilled to determine the character of the material for the purposes of establishing shrinkage factors, as well as to determine the slope on which the material would stand. This core drilling information was augmented with soil samples taken at each point where the subgrade passed from excavation into embankment. Soil samples were also taken at points where the material looked questionable, as to whether or not it could be used for embankment, as observed during a preliminary field view.

Samples were analyzed by the Pennsylvania Department of Highways Testing Laboratory. On the basis of these tests the bearing values of the various soils were determined.

Special subgrade used

It was found advisable to provide an insulation course or special subgrade throughout most of the thirty-eight miles. This special subgrade varies in depth from 6 to 9 in. and extends under the center divisor and 1 ft. beyond the outside edge of pavement. It consists of hard shale or broken stone taken from the roadway excavation and has to be sufficiently hard to withstand compaction under a ten-ton roller without excessive crushing. The material may vary in size from a maximum of 4 in. to fines, with sufficient of the smaller size particles to prevent loss of mortar from freshly laid concrete. The contractor has the alternative of using

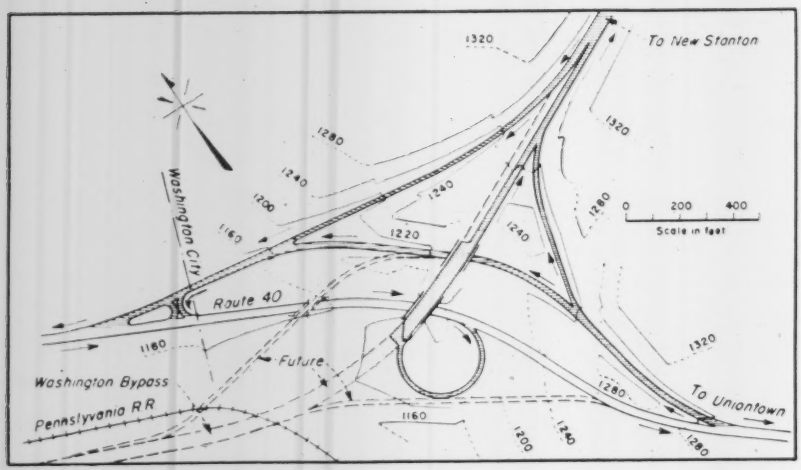


Fig. 3. At the Washington terminus and interchange where the new road crosses Route 40, rugged terrain requires the steepest grades and sharpest curves on the 38-mile highway.

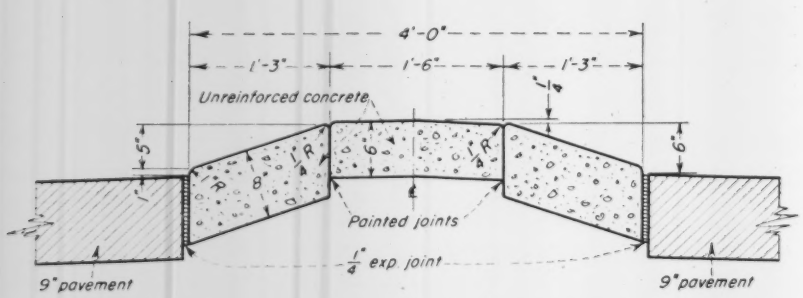


Fig. 4. Center divisor is a raised separation strip rather than a barrier.

commercial material, in lieu of crushing and grading the material from roadway excavation.

A minimum right-of-way of 120 ft. is provided with additional slope easements where the excavation or embankment extend beyond. Right-of-way is widened as required at all interchanges and, in general, the entire area between ramps and connecting roads has been included within the required right-of-way.

The grades and alignment are unusual for the character of topography traversed. With the exception of some 1,700 ft. of 4 percent grade in the Washington Interchange, the maximum gradient throughout the 38 miles is limited to 3 percent. The sharpest curve has a radius of 1,433 ft. and there are only 38 curves in the 38 miles.

The difficulty in obtaining such alignment and grades in the rugged foothills of the Western Allegheny Mountains is best shown by the quantity of excavation involved. The total estimated excavation is 10,200,000 cu.yd. or an average of about 270,000 cu.yd. per mile. The heaviest grading is in the vicinity of the Monongahela River crossing where 1,700,000 cu.yd. of excavation is involved in a distance of 1.65 miles and at the interchange with Route 40, which requires about 840,000 cu.yd. The estimated cost of the entire project is about $25,000,000, exclusive of property damage.

Nine contract sections

The project is divided into nine proposed contract sections, exclusive of the Monongahela River Bridge. This major structure will probably be let in two additional contracts. Surveys and design were started in June 1944 and all plans except the Monongahela River Bridge, which is being designed by the Pennsylvania Department of Highways Bridge Department, were completed by the spring of 1946. As noted above, actual construction work was started in July 1946. This consisted of a $2,100,000 contract covering a 5.71 mile stretch between Bentleyville and the Monongahela River. Unfavorable prices have stopped further letting at this time but it is anticipated the project will get into full swing soon.

This work, except the Monongahela River Bridge but including the Youghiogheny River Bridge, was surveyed and designed for the Pennsylvania Department of Highways by Gannett Fleming Corddry and Carpenter, Inc., Engineers, of Harrisburg, Pa. It has been under the direction of S. P. Longstreet, district engineer of the Department of Highways. The writer was in charge of the work for Gannett Fleming Corddry & Carpenter, Inc., and was ably assisted by Allston Dana, formerly of the Port of New York Authority, who was in charge of the structural design, and Frank J. Williams, who was in charge of the highway design. The work was designed in the Greensburg, Pa. office of the company, with field offices for surveyors in Bellevernon and Bentleyville, Pa.

The average office force consisted of 22 employees and the field force usually had six survey parties. The job from survey to finished plans and specifications, ready to let contracts was done in a little over two years.

Motion Pictures Aid Traffic Study

Using movies to record auto movement at intersections, traffic experts have evolved a new method of controlling traffic congestion on busy streets.

The International City Managers' Association reports that New York City, New Haven and Hartford, Conn. were used as "guinea pig" cities for the study by the Yale Bureau of Highway Traffic.

By analyzing intersection traffic movement as recorded on film, the bureau has devised a formula by which behavior of free-flowing traffic is predicted by application of the laws of probability.

The bureau plans to apply this formula to reduction of delays and congestion at intersections caused by improper timing of traffic lights and placement of stop-signs.

Sungari River Dam Declared a Hazard

A LARGE concrete dam on the Sungari River in northern Manchuria was left by its Japanese builders in such a condition that in the event of an extreme flood or perhaps an earthquake, there is said to be risk of a failure that would endanger millions of people in the valley below. Information to this effect is contained in a voluminous report by John S. Cotton, chief engineer, National Hydroelectric Engineering Bureau, National Resources Commission, Nanking, China. Comment on the present condition of the adjoining hydroelectric plant was given in Martin Bennett's report on Manchuria in *Engineering News-Record* Mar. 6, 1947, vol. p. 381.

The following has been taken from Mr. Cotton's "Report on Completion and Rehabilitation of the Sungari (Ta-Fung-Man) Multiple Purpose Project Near Chi-ling, North-East Provinces (Manchuria), China."

Japanese plans for the project were aimed at a power output of 560,000 kva. to be developed by eight 70,000-kva. generators. Only five of these were installed by the Japanese. Due to the fortunes of war only two units remain. These remaining units supply power to the Changchun and Mukden areas. The dam, built as part of this project and which was left 89 percent complete, is 3,800 ft. long and was designed for a height of 300 ft.

The report cites five reasons for lack of stability in the dam as it stands, namely: (1) Cross-section as constructed is too slender (creating very high tensile stresses), (2) excessive uplift (leakage is generally under high pressure), (3) low-strength concrete, (4) lack of shear keys in longitudinal joints above El. 220 m., (5) lack of grout in longitudinal joints. These conditions, Mr. Cotton believes, make the safety factor of the dam practically unity under extreme flood conditions.

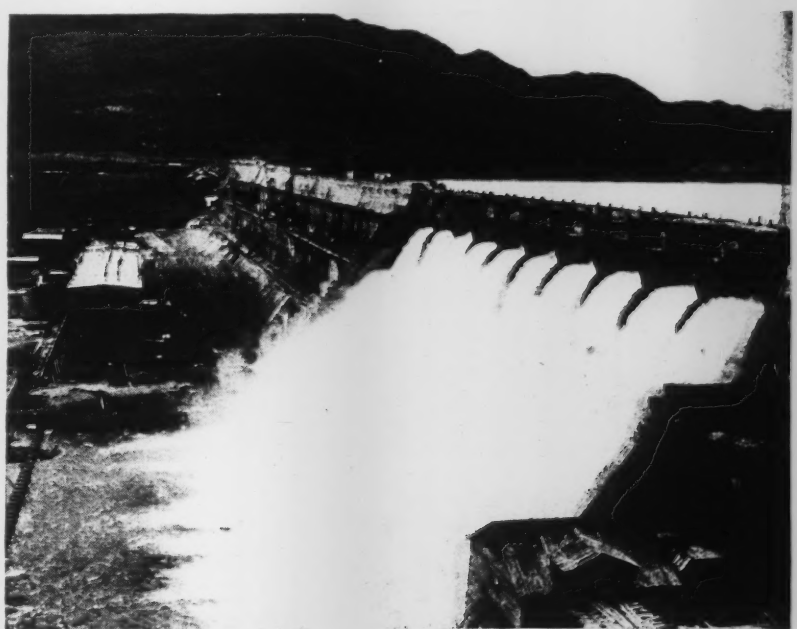
J. L. Savage, consulting engineer, is quoted as recommending that the spillway crest be cut down sufficiently to pass extreme floods without allowing the crest to rise above the highest water level that has occurred since the dam was built. Preliminary studies indicate that this would involve removing about 12,000 cu. yd. of concrete from the spillway. This would later be replaced in rehabilitation of the structure.

Early construction recommended

Mr. Cotton's report recommends that because of the hazard, construction should start at once, first to make the dam safe and then to develop urgently needed power and to provide flood control. The proposed work, under Mr. Cotton's plan, is divided into two parts. On the basis of installing four 70,000-kva. generating units (in addition to the two now operating) the first part would consist of emergency work on the dam, ordering and assembling equipment and materials, and rebuilding the construction plant. This would involve commitment for ultimate expenditure of $10,600,000. The emergency work consists of (1) lowering the spillway crest, (2) pouring concrete in most critical dam sections, (3) excavating shafts between blocks in dam to improve resistance to vertical shear forces, (4) grouting upstream face of dam by means of diamond drill holes to stop leakage, (5) repairing spillway apron, which is 40 percent disintegrated, (6) repairing seven spans of a wrecked bridge and (7) putting concrete plugs in three penstocks 25 ft. in diameter. This emergency work was started last March with a crew of 1,500 men. Good progress was made until May when strikes and the current civil war held up the work.

In the second period, which would follow the first stage, the heavy construction work would actually start under a program calling for expenditure of another $1,243,000, thus bringing the total of presently projected work to $11,843,000.

The text of the report comprises some 115 mimeographed pages in addition to which there are tables, diagrams and plans. The tabulations and drawings are devoted chiefly to the proposed rehabilitation of the project for which a complete and detailed program with cost estimate is included.



Ta-Fung-Man Dam in Manchuria, which was left in an uncompleted state by the Japanese, has been declared by American engineers to be so unstable as to be a menace to the lower valley of the Sungari River.

BUILDING DESIGNERS' LIBRARY

Electric Systems for Industrial Plants

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New York, N. Y.

***Contents in Brief**—Electrical service should be provided in the original design of industrial buildings for estimated future needs as well as for initial requirements, if later structural alterations are to be avoided. To be assured of flexibility of plant, building designers should verify that the following have not been overlooked: Checking of voltage supplied by the utility company and equipment required; determination of present and probable future electrical loads; and provision in the plans of space and foundations for the associated installations.*

IMPROVEMENTS in lighting and addition of air conditioning in existing buildings are only two of many electrical installations that have necessitated extensive changes in structural design that could have been avoided by foresight in initial planning. Sometimes the entire electrical distribution system has had to be replaced.

The purpose of the electric system is to transmit energy from the source of power to the point of utilization, and it is the electrical engineer's job to design such a system to fulfill its purpose in the best and most economical manner. But it is the function of the building designer to see that provision is also made for probable future needs: The architect should provide space for additional switchgear, transformers and cables; the structural engineer should include supports for the installations. An outline of the factors involved in the selection of a distribution system should, therefore, be helpful to those who would not normally design electrical installations but who nevertheless would be responsible for designing a plant for flexibility of operation.

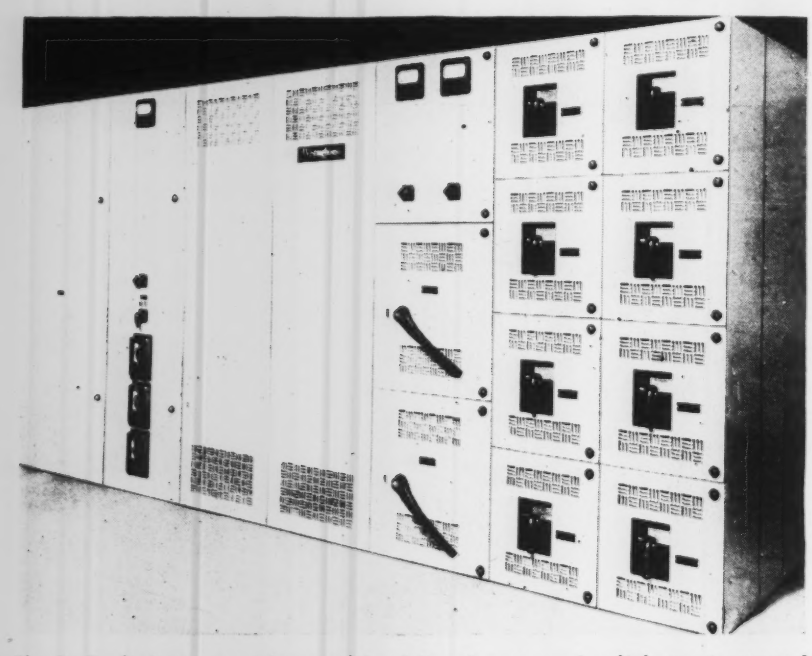


Fig. 1. Typical power center consists of transformers and switchgear to convert high-voltage supply to low-voltage feed for load.

Computing the electrical load

The first problem in the design of an industrial distribution system is to determine the electrical load of the plant. If a complete layout is available, giving size and location of machinery and lighting requirements, determination of load is simple. However, in many cases, this information is not known in advance, and reasonable assumptions must be made. Load density may be assumed as follows: Power, 5 to 25 v.-a. per sq. ft., and lighting, 2 to 8 v.-a. per sq. ft., giving a total of 7 to 30 v.-a. per sq. ft. Typical values for various types of plants may be obtained from handbooks, and when used with discretion give close estimates. Ample space should be provided for future needs, such as additional transformers, cable and switchgear equipment.

Power must be dependable

Reliability of the power source must be considered, for no distribution system can overcome a weak or uncertain supply. Where continuous operation is a requisite, two distinct sources are necessary, particularly where loss of power causes production stoppages, damage to materials in process and possibly death. Continuous operations in which a power failure would have serious consequences occur in chemical plants, oil refineries, ventilation of mines, research laboratories and hospitals.

When two incoming lines are justified, each line should originate from different sub-stations or bus sections and travel by different routes to its

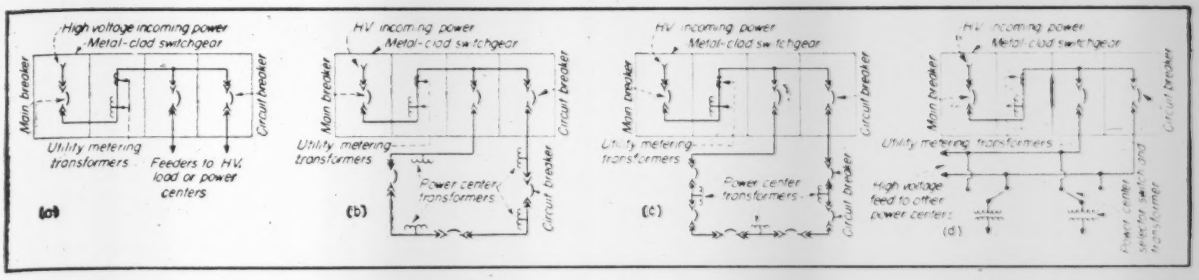


Fig. 2. High-voltage distribution systems: (a) simple radial, (b) looped primary, (c) alternate loop system and (d) primary selective. Incoming power is fed to high-voltage loads or to power centers for transformation to low voltage.

destination, thus reducing the possibility of simultaneous failures. Less susceptible to damage from the elements, underground cable feeders are usually preferred to overhead lines.

The voltage of the supply is determined by the utility company, if the plant is using purchased power. Usual standard distribution voltages are 120/208, 240, 480, 2,400, 4,160 and 13,200. In most cases, the approximate maximum power demand must be computed before the utility company can determine the voltage. It is the electrical engineer's job to make this voltage fit his particular plant distribution system, either using the supply voltage or changing it by the use of transformers to a more suitable value.

Due to the many varying conditions for different plants, it is impossible to give a definite rule for the load that should be considered at the various standard voltages. However, as a general guide, the following tabulation may be used:

Max. Load Kilovolt-amp.	Min. Supply Voltage
500	120/208 or 240
1,000	480
7,500	2,400
12,000	4,160
45,000	13,200

In some special cases other voltages, such as 6,900 v., may be used. Also, the amount of power available for the plant must be considered from the viewpoint of the present and probable future loads, and provisions must be made in the design of the distribution system for a reasonable increase, so that the switchgear and cables do not have to be changed soon after their installation.

After the above data are assembled, the next major problem is to select a type of distribution system that is best suited to the particular plant. There are two main types: High voltage—2,400 to 13,200 v.; and low voltage—110 to 575 v. Smaller plants, 1,000 kva. or less, usually use only a low-voltage system. Larger plants use both high voltage and low voltage, the former being used to feed power centers, consisting of transformers and low-voltage switchgear, located as close to the center of the load as possible. The low-voltage switchgear is used as the main distribution center for the feeders to the load.

High-voltage systems

In high-voltage distribution there are three basic systems: Simple radial, looped primary and primary selective.

The simple radial system (Fig. 2a) normally consists of the following: A main incoming-line breaker unit with the proper breaker, tripping transformers, relays and instruments; a metering unit accommodating metering transformers, meters, relays and other auxiliary equipment required by the utility company; and two or more feeder breaker units, the number of feeders depending on the plant layout, each with the proper breaker, tripping transformers, relays and instruments. Entering the system through the main breaker, power passes through the metering compartment, and then is fed to the plant through the various feeder breakers. The advantages of this system are that it is simple to operate and relatively inexpensive. The main disadvantage is that if there is a feeder-cable fault, service to the load fed by this feeder is out until the faulted line is repaired or replaced.

The looped primary system (Fig. 2b) consists of the main breaker units, the utility metering, and normally two feeder breaker units. Making a loop through the plant, these feeders are connected to the various power centers and supply the entire load. At each power center, a high-voltage breaker is inserted to provide for opening the circuit in case of a fault in the loop or in one of the transformers. Normally, only one power center is disconnected from the source.

The disadvantage of this system is that it is more involved to operate, due to the coordination required of the loop-breaker relays, which must be set so that only the faulted section is disconnected. Advantages are that the ties between power centers are shorter than the radial feeders and consequently require less maintenance.

There are other types of loop systems, such as the one shown in Fig. 2c. Here, two breakers are used at each power center, and while a fault on the loop may be disconnected from the system, none of the loads need be. Also, a section of the loop can be disconnected for test purpose at any time without loss of load. Usually requiring additional relaying and breaker equipment, this system is more expensive, but it gives very reliable service.

The primary selective system (Fig. 2d) consists of the main breaker unit utility metering and two or more feeder units. Though two feeders radially feed the entire load, or if a large plant, sections thereof, each feeder has sufficient capacity for the entire plant (or section), so that if one cable is out the load is transferred to the other feeder. For this purpose, a selector switch is provided on the high-voltage side of each power-center transformer. Thus, in a relatively short time a faulted feeder can be cut out of service, the load transferred to the good feeder and the entire plant put back in service. A dis-

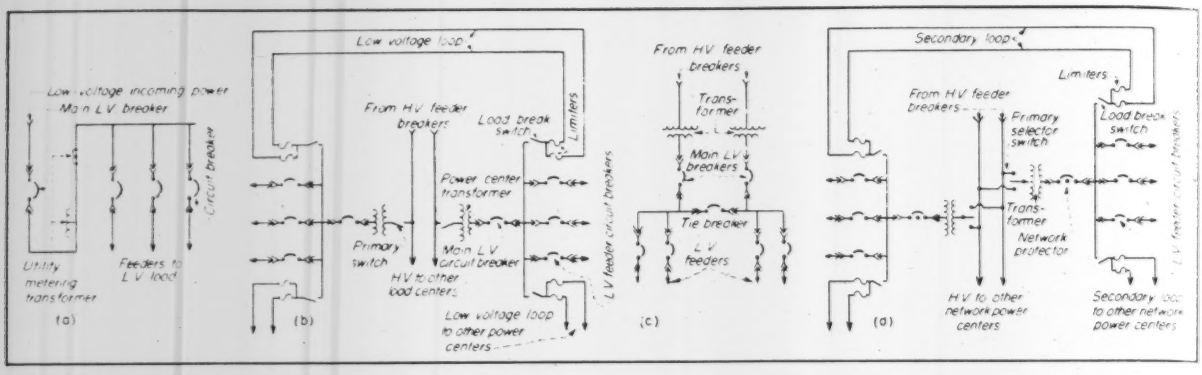


Fig. 3. Low-voltage distribution systems: (a) simple radial, (b) banked secondary, (c) low-voltage selective and (d) primary selective network. Transformed from high voltage, power is fed to loads by one of these systems.

advantage is that when a fault occurs half the load is down for a short period of time.

Low-voltage systems

In low-voltage distribution there are four basic systems: Simple radial, banked secondary, low-voltage selective and primary selective network. The simple radial (Fig. 3a) is similar to the high-voltage radial system, except that the low-voltage feeders supply power directly to the load instead of to power centers. If the load is not too large and the power is supplied at a low voltage, this system is usually the least expensive to install and gives satisfactory service. Unless there are unusual conditions, the maximum plant load at 120/208 or 240 v. should not be more than 500 kva., and at 480 v. should not exceed 1,000 kva.

The banked secondary system (Fig. 3b) consists of two or more power centers with the low-voltage sides of all transformers tied together to form a loop. Due to selective relaying and the relatively high current, there are two tie lines in parallel with limiters at each end. Therefore, if trouble occurs in one of the transformers, the corresponding load can be fed through the tie lines from the other transformer banks.

The low-voltage selective system (Fig. 3c) consists of two or more power centers, connected in pairs on the low-voltage sides through a tie breaker. Normal operation is with the tie breaker open, to reduce the interrupting capacity required of the feeder breakers, and the main transformer breakers interlocked with the tie breaker to prevent paralleling. If trouble occurs in one of the transformers, it can be disconnected from the line and the load fed from another transformer until repairs are made to the faulty equipment.

The primary selective network system (Fig. 3d) is very similar to the banked secondary, except that a network protector is used instead of the main secondary transformer breaker, and each network transformer is equipped with a primary selector switch. The network protector is a specially designed low-voltage breaker with all the necessary coordinating relays to provide uninterrupted service under almost any condition when two sources of power are used. In a plant requiring two primary feeders, each feeder must be capable of supplying the entire load, and the two primary feeders are taken to each transformer primary selector switch. The tie circuits between the low-voltage sides of the transformers are protected and coordinated by the use of limiters. Use of this system by many utility companies has proved it the most dependable low-voltage distribution system, and its cost is less than that of any other system of comparable reliability.

APPROX. SPACE REQUIREMENTS

(Including Recommended Front and Back Aisle Space Adjacent to Equipment)

FOR SWITCHGEAR

(Note: 1—Metering Unit, 1—Main Breaker Unit and 2—Feeder Breaker Units for 5,000-v. service assumed)

I. C. of Breaker	Width in.	Depth in.	Height in.
50,000	90	150	90
100,000	114	170	90
150,000	114	170	90

FOR POWER CENTER WITH HIGH-VOLTAGE SELECTOR SWITCH

(Note: 1—Main Low-Voltage Breaker and 8—Low-Voltage Feeder Breakers Assumed)

Transformer kva.	Width in.	Depth in.	Height in.
	120/207 v.		
300	164	134	90
500	174	134	90
750	224	134	90
	480 v.		
300	150	120	90
500	174	134	90
750	174	134	90
1,000	184	134	90

Wood-Wool Slabs Widely Used in German House Construction

Wood-wool slabs are generally used in German dwelling construction in place of the plaster and fiber board commonly used in Great Britain and America, according to a comprehensive report on the German wood-wool building slab industry now on sale by the Office of Technical Services, Department of Commerce.

Three types of slab are manufactured. About 55 percent of total production is a slab bound with magnesium oxysulphate. About 30 percent is bound with Portland cement, and 15 percent with gypsum plaster.

The main body of the report contains a detailed description of the processing of raw materials into wood-wool slab at the seven plants visited. The appendices contain detailed descriptions of machinery used.

Orders for the report (PB-75807: *The German wood-wool building slab industry;* photostat, $5; microfilm, $2; 66 pages) should be addressed to the Office of Technical Services, Department of Commerce, Washington 25, D. C., and should be accompanied by check or money order, payable to the Treasurer of the United States.

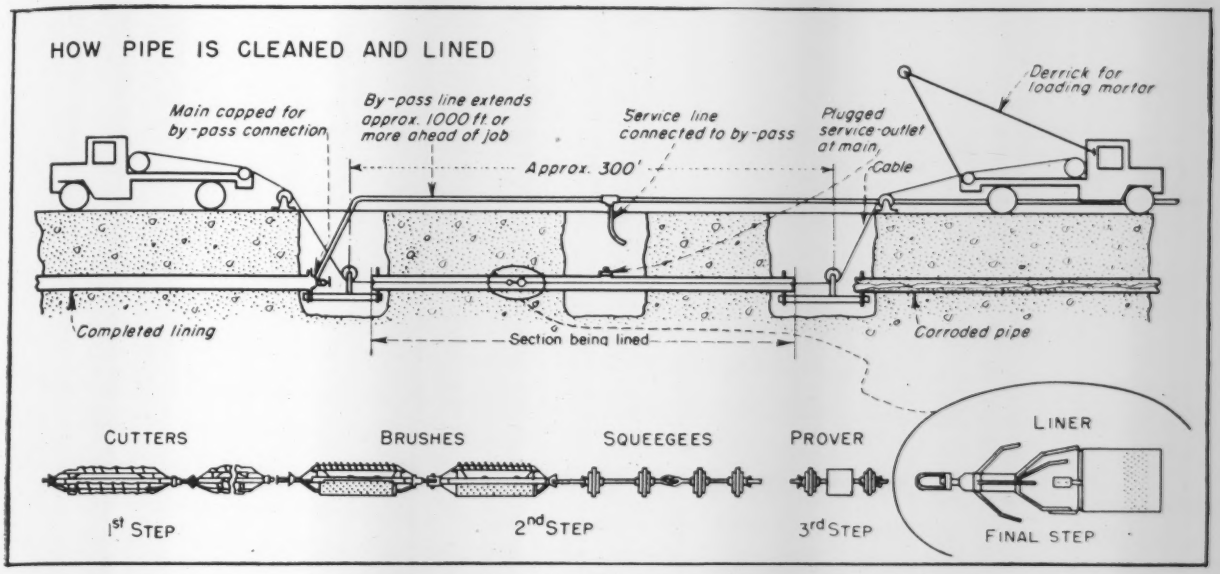


Fig. 1. Sections about 300 ft. long are cleaned and lined after installation of a temporary by-pass. The process includes four steps: Cutting and removing deposited material, checking the diameter, and lining with cement mortar.

Small Water Mains Cleaned and Lined in Place

***Contents in Brief**—Tuberculation was removed recently in some 29,700 ft. of 6-, 8-, and 12-in. cast-iron pipe in the distribution system of the East Bay Municipal Utility District (Calif.) and the pipe, while still in place, was lined with cement mortar. The cost was somewhat less than that of a new installation and the Williams-Hazen hydraulic coefficient "C" was increased from 50 to 120.*

SOME 29,700 FT. of 6-, 8-, and 12-in. cast-iron pipe was cleaned and lined in place recently in the distribution system of the East Bay Municipal Utility District which serves Oakland, Calif. and other nearby cities. This pipe, 40 to 80 yrs. old, was affected seriously by tuberculation, reducing the Williams-Hazen coefficient to as low as 45. By use of the Tate process mains were cleaned and lined with cement mortar that restored high hydraulic efficiency,—all at a cost somewhat less than that of a new installation.

About 10 years ago, engineers found that tuberculation in some old unlined cast-iron mains had reached the stage where corrective measures were necessary. Contracts were let for cleaning some of the pipe by a method whereby water pressure forces a cleaning device through the pipe. Good operating characteristics were achieved immediately and for a period of two years the Williams-Hazen coefficient "C" remained close to 120. However, during the third year rapid incrustation took place and these sections returned to their "before cleaning" condition. Cleaning was not enough. In fact, district officials felt it was a waste of money.

Lining started in 1943

In 1943, some of these mains were cleaned and lined by the Tate process. As this trial proved successful, another and much larger contract for cleaning and lining of all small, un-

Fig. 2. As brushes emerge from the pipe, much material is carried out.

Fig. 3. Mortar is loaded through a riser connected to one end of the pipe.

lined, cast iron pipe urgently in need of attention was let in 1946 and the work was completed a year later.

Including 14,400 ft. of 6-in., 8,700 ft. of 8-in., and 6,600 ft. of 12-in. pipe, this contract was executed for about three-quarters of the cost of new mains in the same locations, and the result was equivalent to a new installation, except for a slight decrease in diameter.

Cost less than new pipe

In some cities, water mains have been refurbished by the Tate process for one-half the cost of new pipes. However, local conditions—such as, number of services, necessity of maintaining fire-fighting pressures, and character of pavement, determine the total cost of rehabilitation. In any event, less excavation and street paving are required when new pipe is not required.

The Tate process was developed by W. T. Tate of Sydney, Australia, some 20 years ago for use on the Sydney water system. It has been used in many foreign countries and the United States to a varying degree for over 10 years. By this process steel or cast-iron pipe as small as 3 in. in diameter and as large as 18 in. in diameter can be cleaned of incrustation and deposition and lined with cement mortar from $\frac{1}{8}$ to $\frac{3}{4}$ in. thick.

On the East Bay work, 250 to 300-ft. sections of main were inactivated for cleaning and lining. First, these were temporarily by-passed, either singly or in groups of two or three, with 2-in. pipe laid in the gutter. Consumer services, located from large-scale maps furnished by the district, then were joined to the by-pass by means of flexible connections. In this way water service was maintained with little interruption.

After corporation cocks had been removed from the main, $\frac{3}{4}$-in. plugs were inserted so as not to protrude inside the pipe. These plugs prevented clogging of services and loss of mortar during lining.

Truck-mounted winches used

At each end of the inactivated section, a work hole was dug and a 4-ft. length of main extracted. Then $\frac{1}{4}$-in. flexible sewer rod was pushed into and pulled through the section in order to thread the $\frac{5}{8}$-in. operating cable into the pipe. By means of truck-mounted winches situated at each end of the 300-ft. section and the cable, scrapers and cleaning devices were hauled through the incrusted pipe. Scrapers were fitted with cutting edges expanded radially by means of springs.

After adhering material had been loosened, sections were flushed out with water. Heavy steel brushes and rubber squeegees were then pulled through by the winches and cables for cleaning and moisture removal. Before lining, a prover set between two rubber plungers was passed through the main. This prover consists of a steel cylinder $\frac{1}{8}$ in. larger in diameter than the lining machine to be used and its purpose is to detect any obstructions left in the main—such as, forgotten house connections, blisters on the pipe, spigots not centered in bells, and misshapen pipe.

Fig. 5. Typical section of 8-in. pipe after being lined by the Tate method.

Fig. 4. The liner is inserted in the pipe after the mortar charge.

To load mortar, a vertical pipe is set up at one end of the section and connected by means of a bolted coupling. Then, the loading pipe is filled with mortar which is forced into the section by a plunger pulled back and forth by the cable. This process is repeated until the required amount of mortar is in the pipe. For a 300-ft. section of 8-in. pipe, some 50 cu. ft. of mortar is required.

Mortar for the lining work is mixed by hand methods in an open tray while the final cleaning operations are going on. In this manner it is ready when needed and the operations can continue without unduly delaying the crew of one foreman and 16 men. The mortar consists of a mixture of two parts of carefully graded and washed sand to one part of cement. The slump is carefully controlled by adding water slowly during mixing. The quality of the finished lining is dependent on proper slump. The smaller the pipe

size, the larger the slump required.

After the mortar has been loaded, the charging pipe is disconnected and the lining machine or mandrel is connected to the cable. Then it is drawn through the pipe at a rate of about 15 ft. per min.

Method of placing the lining

The lining machine, sometimes called the dehydrator, is shaped like a projectile and has protruding springs on the forward end which are adjusted to hold the dehydrator in the center of the pipe. The lower end has two distinct functions. The last 2 in. or so are smooth and act as a trowel, and the portion just above is perforated so that excess water, cement in suspension and fine sand are forced out of the mortar through the holes. The holes are conical in shape with the small end of the cone at the outside circumference so that when water or sand passes into the hole, it will pass on through without blocking the hole.

The portion of the mortar which passes through the holes of the dehydrator is left on the bottom of the pipe where it soon becomes hard and leaves a flat section at the bottom of the lined pipe. The only objection to such a flat bottom is that it decreases the area available for the flow of water. In fact, the high values of C attained as a result of the Tate process are attributed by some to the flat section, which is said to prevent rifling or "cork-screw" action of the stream.

During the passage of the mandrel through the pipe, all joints and taps for services are filled with mortar, making the pipe lining continuous. The filled joints and flat invert are claimed by the Tate people to be unique features of the process. The plugs for service taps are taken out and the mortar is broken away from the holes about 24 hrs. after completion of lining. The pipe then can be returned to service immediately.

According to officials of the East Bay system favorable results have been obtained on this pipe cleaning and lining program. Williams-Hazen coefficients have been increased from about 50 to better than 120. In fact, the contract guarantees that C will be at least 120 on the basis of the reduced area and that the lining thickness will be ¼ in. or less. Tests indicate that these conditions have been met. On the basis of the original area of the pipe section, the resulting C has been about 105. The decrease in area in two specific instances was 17.2 percent for 6-in. pipe and 12.9 percent for 8-in. pipe.

Tests made after some of the new lining has had 2 to 3 years of service have shown that the C values have remained at nearly the same levels and in some instances increased to as high as 140. This latter is attributed to the formation of a slick coating on the mortar lining not present when original tests were made.

The work was performed under the supervision of W. R. McLean, senior civil engineer, East Bay Municipal Utility District. J. D. DeCosta is engineer in charge of water distribution and J. S. Longwell is chief engineer and general manager for the district. Dana Mansur supervised the work for Tate Pipe Linings Inc. and Bruce Harkness, Monrovia, Calif., is Western manager, and patentee's representative.

Nine States Enact Toll Road Legislation

Legislation authorizing the construction of new toll roads or extension of existing turnpikes was enacted in nine states during 1947 state legislative sessions a survey by the National Highway Users Conference reveals.

Statutory authority for construction of new toll roads was granted in five states—Colorado, Georgia, New Hampshire, Oklahoma and West Virginia. In *Colorado*, the State Highway Department was authorized to construct turnpikes and finance them by tolls. The project under primary consideration is a four-lane highway between Denver and Boulder. The *Georgia* Legislature authorized the construction of a toll highway by the Georgia Coastal Scenic Highway Commission (consisting of representatives from Camden, Glynn, and McIntosh counties, as well as representatives from other coastal counties who may wish to participate). Construction of an 18-mile toll highway from Seabrook to Portsmouth is provided by *New Hampshire* law. Unlike provisions in other states, the funds are to be raised through pledging the credit of the state, up to $7,500,000. Issuance of bonds and construction of the highway are conditioned upon the making of a complete traffic survey and the finding of feasibility and practicality of the proposed toll road. The *Oklahoma* Turnpike Authority was created, with authority to construct a toll express highway between Oklahoma City and Tulsa. Construction of the highway must begin within 2 years from the effective date of the act (August 6, 1947). Estimates of costs have varied from 25 to 50 million dollars.

Wide authority in the construction of toll roads in *West Virginia* is provided by legislation creating the West Virginia Turnpike Commission. Thus far, no specific routes have been announced by the Commission.

Four other states have enacted varying toll road legislation. The *California* Legislature broadened the authority of the California Toll Bridge Authority to include approach roads within 50 miles of toll facilities. At the same time, the Legislature rejected extensive plans for a network of toll roads, one of which contemplated a $2,000,000,000 system. *Maryland* revised and enlarged the existing authority for construction of toll roads, especially as to the construction of auxiliary facilities, refunding of bonds, and the granting of concessions. *New York* legislation provides for the collection of tolls on the Fleetwood Viaduct for the retirement of Westchester County Parkway bonds. A *Pennsylvania* enactment authorizes combining the revenues of the Pennsylvania Turnpike with those of the proposed eastern and western extensions in order to finance the cost of such extensions and the refunding of any turnpike bonds. The Governor vetoed a bill empowering joint action with Ohio, West Virginia and Indiana in the westerly extension of the turnpike.

Toll legislation was defeated in Connecticut, Florida, Maine, Ohio and Washington.

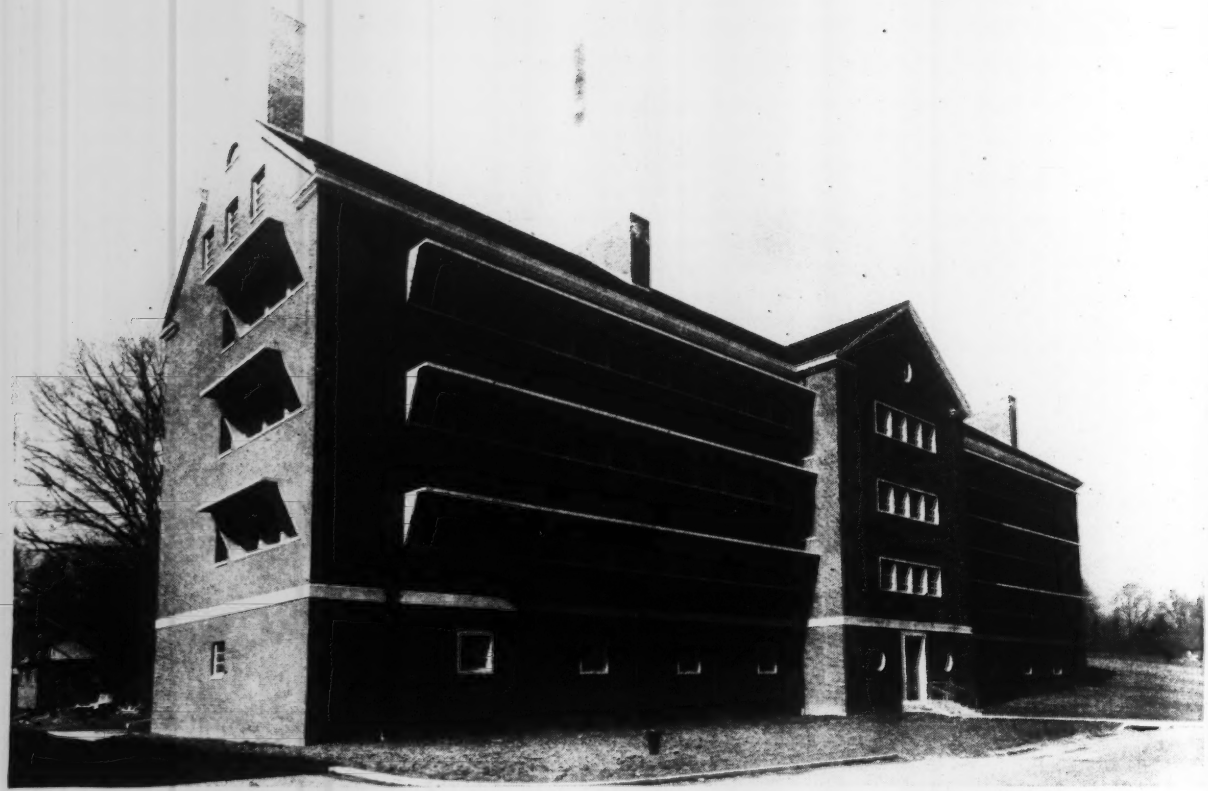


Fig. 1. Continuous solar canopies are provided above the windows to avoid the use of shades on the inside of the new laboratory for the study of infectious diseases at the National Institute of Health, Bethesda, Md.

A Laboratory Building for Study Of Highly Infectious Diseases

***Contents in Brief**—To permit study of the most infectious diseases of mankind, an air-conditioned building with many special features was constructed at the National Institute of Health by the Public Buildings Administration. These include cantilevered solar canopies for the windows, decontamination locks through which workers must pass on entering and leaving the laboratory areas, and the use of electrically heated grids for sterilization of the air leaving the contaminated areas.*

NOW NEARING completion at the National Institute of Health at Bethesda, Md., is a laboratory building designed specifically for the study of many of the infectious diseases most dangerous to mankind. The structure incorporates several features that are considered unique.

Eleven scientists lost their lives and over 100 people had serious illnesses from working with these deadly disease germs in the old laboratory quarters. Therefore, great care had to be exercised in designing and constructing the new building to prevent continuance of the frequent severe sickness and loss of life.

Space was required for about 100 laboratory workers and helpers in six large laboratory units. Each unit was to contain space for study of the diseases in mice, rats, rabbits, guinea pigs, monkeys and other small animals. Also, library reference rooms and administrative offices were required.

To meet these needs, a four-story building measuring 47 x 196 ft. was designed. The ground floor is devoted primarily to storage space and machinery rooms. On each of the other three floors a laboratory unit is provided at either end, including animal rooms and special work areas. A reading room and study quarters are also available in a clean area in the center of the building. A typical floor plan of the upper floors is illustrated by an accompanying drawing (Fig. 2).

Exterior walls of the structure are of wall-bearing design. They are 13 in. thick and consist of 4 in. of brick

and 8 in. of reinforced concrete separated by a 1-in. air space.

Windows are composed of three hermetically sealed thicknesses of glass. They are shielded with reinforced concrete solar canopies, because the use of venetian blinds or other types of shades on the interior of the walls was objectionable as possible dust collectors. The canopies vary in width, dependent upon their location, with the maximum about 4 ft. To simplify construction, they were made continuous and were cast at the same time as the floors as cantilevers.

Walls tiled for ease of cleaning

The main interior walls were also made wall-bearing, and for the most part consist of 8 in. of reinforced concrete. Partitions are constructed of 4-in. terra cotta tile. To provide for easy cleaning, the interior surfaces of the walls and partitions in the laboratory and special work areas are surfaced with hard, glazed tile from floor level to ceiling.

Designed for a live load of 100 psf., the floors are of reinforced-concrete pan construction. They are surfaced with asphaltic tile in the laboratory areas, and with quarry tile in the animal rooms and corridors. Suspended ceilings consist of plaster on metal lath.

The roof is of steel-frame construction. It is sheathed with 2-in. thick metal-bound gypsum plank and covered with slate.

Decontamination locks used

To assure maximum safety for the laboratory workers, many precautions had to be taken. Each of the six laboratory units is entered through a decontamination lock, with duplicate facilities for men and women. The people who work in the contaminated areas must enter and leave by passing through these locks. Each lock has a vestibule with lockers to receive street clothes; beyond is a shower, leading to a second locker room for laboratory clothes.

To provide added safety, it was also specified that almost the entire building be air conditioned and that the system be designed to prevent contamination between one laboratory area and another. Four air-conditioning units installed in the attic are provided.

Air is taken from outside only, through stacks at the ends of the building. After passing through the filters, preheaters and surface dehumidifiers, it is delivered by fans directly to the cold air plenum chambers. An individual sheet-metal duct leads to each conditioned room, the ducts being supported above the suspended ceiling.

In the laboratory areas, maximum freedom from air currents is necessary to reduce the travel of airborne germs within the laboratory room, and at the same time necessary currents are to be kept away from workers as much as possible. To meet this restriction, fresh air is delivered by numerous ceiling outlets equipped with large perforated diffuser plates that spread the incoming air over a big area (Fig. 4). The discharge outlets are located just above the work tables along the walls and direct the flow away from workers seated at the benches. The total laboratory exhaust exceeds the supply, so that air flows in from corridors, thus minimizing the escape of contaminated air from the laboratories into other parts of the building.

Control of the temperature in each room is accomplished by a room thermostat operating a pair of mixing dampers in the plenum chambers. In contrast, the humidity is not controlled in individual rooms. Instead, thermostats in the dehumidifier tanks provide winter dewpoint control by operating the preheater steam valves. Summer dewpoint control depends only on the temperature of the chilled water supplied to the dehumidifiers. This water is cooled by two refrigerating units, each consisting of a 125-ton multi-cylinder freon compressor, water-cooled condenser and flooded evaporator. The water temperature is controlled automatically.

Condensing water is cooled in two indoor cooling towers, each of which consists of an air washer and a double inlet fan. The washers are similar to those used for ventilating systems and have two banks of sprays. Fans are arranged to blow through the washers and are equipped with adjustable deflectors to control air distribution.

Steam for the air-conditioning system is received from the boiler room in an adjacent building. Reducing valves are provided to deliver the steam at 5 psi. for the air conditioning units and at 35 psi. to sterilizing equipment.

Other precautions taken

In addition to designing the air-conditioning system so that all used air would be discharged to the outside atmosphere, other major steps pertaining to the air supply had to be taken. Much of the dangerous

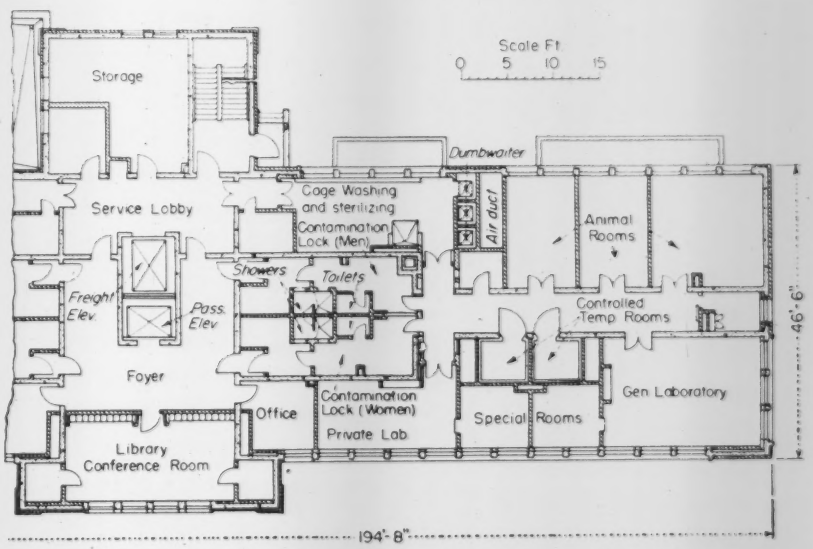


Fig. 2. On each of the three upper main floors a laboratory area is provided at either end. Upon leaving these spaces, the laboratory workers must pass through decontamination locks where they take showers and put on uncontaminated clothes. Shown above is a part plan of the first floor.

Fig. 3. Exterior walls are of concrete and brick, the main 8-in. wall being separated from the brick by a 1-in. air space.

work in the laboratory areas will be carried out under specially designed removable table hoods, of which there are 73 in the building. The scientists will observe operations under the hoods through plate glass windows. A slot 6 in. wide is provided at the bottom of the hoods through which the scientist can work with his hands. Inside all the hoods a negative air pressure will be maintained and the outgoing air will pass over grids heated electrically to a temperature of from 500 to 650 deg. F. to destroy all airborne germs.

In each general laboratory unit, there are also three 6x8-ft. cubicles equipped with microscope tables and work benches. All the air that enters these small rooms is especially filtered by strainers and is sterilized by germicidal lamps. Air leaving the cubicles passes over hot grids of the type described.

Workrooms with specially designed cabinet hoods to house high-speed blenders and centrifuges are also provided. In these rooms extremely dangerous work will be performed. Inside the cabinets the infected fluids and tissues will be ground and the materials separated by centrifuges operating at speeds as high as 75,000 rpm. An invisible spray may result, thereby contaminating the atmosphere. To prevent a worker from opening the cabinets while the centrifuges are operating, the doors are equipped with switches that automatically cut off the power to the centrifuges when the doors are opened. Also, a negative pressure is provided within the cabinets and the exhausted air passes out over grids of the type previously mentioned. As a further precaution, ultra-violet lights are provided to sterilize the interior of the cabinets.

Lighting of special design

Special precautions against contamination were also carried out in connection with the lighting equipment. The general illumination in the laboratory areas is provided by specially designed recessed fluorescent units equipped with control lenses, gasketed and sealed in a frame. The latter is tightly secured by thumb bolts and gasketed to a metal frame installed flush with the plaster ceiling. An intensity of about 40 footcandles is provided in laboratory areas at the level of the work tables.

Illumination within the laboratory hoods is provided by special fluorescent units. These are attached to the outside of the hoods, the lights being directed into the hoods through glazed panels.

Interiors of the hoods are provided with ultra-violet radiation from germicidal lamps. To protect laboratory workers from the undesirable effects of this radiation, lamps are carefully shielded and controlled by automatic switches operating in conjunction with the hood doors.

General offices are provided with fluorescent lighting of the luminous indirect type. Corridors and other utilitarian spaces above the ground floor have recessed fluorescent equipment similar to those in laboratory units, except that they do not incorporate the "sealing" feature.

Electrical power for the building is supplied by feeders connected to the 2,300-volt network buses in the power plant serving the building and adjacent structures. These feeders are protected with circuit breakers and disconnecting switches which are

wholly enclosed in steel cubicles.

Special safeguards were also required in removing all solid waste matter from the animal rooms. This material is collected in stainless galvanized covered cans and transported by dumbwaiters to one of the two gas-fired incinerators on the ground floor. Refuse containers are transported directly from the laboratory to the incinerator charging room. To prevent any possible cross-contamination from one laboratory to another, a separate dumbwaiter is provided for each laboratory. Dumbwaiters are of automatic push-button operation design and are of the worm-geared traction type, the cars being made of stainless steel.

Incinerators are of the brick-encased, steel-framed, high temperature, natural-draft type. The gas burners, which are of push-button starting design, are provided with low-pressure blowers. The incinerators are located below the incinerator charging-room floors and are charged through chutes set flush in the floors.

Two can-washing rooms are provided near the incinerators on the ground floor. They are equipped to wash the cans with water at 200 degrees F., and to clean them with a steam jet. Also, each laboratory has a room for washing the animal cages, and facilities are provided for sterilizing the cages and other equipment in large autoclaves.

Highly infected liquid wastes from the laboratory areas will be sterilized. Liquid wastes from the toilets will be discharged directly into the sanitary sewer system serving the nearby buildings. No special treatment was considered necessary for these latter wastes.

The $1,000,000 building was constructed by the Public Buildings Administration, of which W. E. Reynolds is commissioner. On the job, William E. Kelley was project engineer.

The George A. Fuller Co., Washington, D. C., was the general contractor. For this firm, S. O. Kahout was construction superintendent.

The building will be used under the general supervision of Dr. R. E. Dyer, director of the national Institute of Health, which is a part of the U. S. Public Health Service. The work in the building will be directed by Dr. Charles Armstrong.

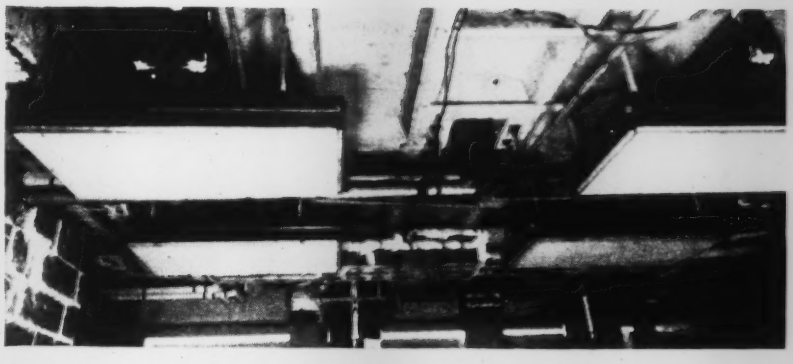


Fig. 4. In the laboratory areas the air-conditioning outlets are equipped with large diffuser plates to reduce drafts within the rooms and thus the danger to the workers of airborne germs. Two of the electrically heated grid units for sterilizing outgoing air are shown in the background.

Fig. 5. Much of the dangerous work in the laboratories is carried out under removable table hoods. A negative air pressure is maintained in the hood, the discharge air passing up the vertical riser shown and over a hot grid that kills all airborne germs. The use of tile for full height of walls, recessed fluorescent lighting and special sliding door is to be noted.

Fig. 6. The cages in which small animals are kept are supported on steel frames supported from overhead steel rails. This method of support permits frames to be shifted about easily and simplifies cleaning of the floors.

Precast Fireproofing on Used Steel Reinforces Columns for Re-use

***Contents in Brief**—By precasting reinforced concrete around old structural columns, in a manner similar to casting piles, formwork and time were saved in erection of a printing plant in Philadelphia. Immediate availability of material was the primary reason for utilization of the old structure*

FIREPROOFING and reinforcing of used steel columns was done in a single action on the ground in re-erecting a sawtooth mill-type building for Cuneo Press in Philadelphia. The structure originally was erected in Buffalo more than 30 years ago as a railroad car-building shop and had not been in use for some years. All of the steel framework of the old structure—columns, roof trusses, purlins and sash—was shipped by rail to Philadelphia as were precast concrete roof slabs. The old building was some 20 percent larger than the 225x270-ft. size of the new structure so that deteriorated parts of the old steel could be discarded.

In the structure, triangular trusses span 30 ft. with columns spaced 35 ft. 6 in. transversely. At the center of the 35 ft. 6 in. span an intermediate triangular truss is supported from the high transverse truss of the sawtooth roof design. Purlins span 17 ft. 9 in. to carry precast roof slabs.

The owner purchased the old structure with the expectation of re-erecting it practically as it had stood for 30 years in Buffalo. After the material was shipped to Philadelphia, it was found that to meet the Philadelphia building code it was necessary to reinforce many of the columns. It was also found that insurance rates, for the printing plant use to which the structure was to be put, would be sufficiently lower to justify fireproofing all of the columns in the plant.

Foundations for the structure are spread footings on natural ground. Some 2 ft. 6 in. greater headroom required for the new structure, compared to its original use, was secured by extending the concrete footings that distance above the floor level.

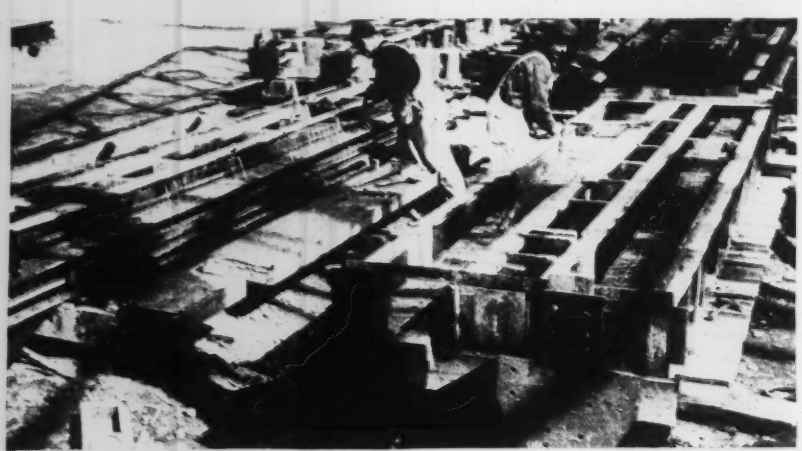
The original plan was to reinforce the 22-ft. 6-in. high columns with four 3 in. x $2\frac{1}{2}$ in. x $\frac{5}{16}$ in. angles 17 ft. 6 in. long on the outside of the flanges, using continuous welds for 8 in. at the top and bottom with 2 in. welds at 8 in. centers for the rest of the full length. The contractor suggested fireproofing the columns with structural concrete, using reinforcing bars in the concrete to give the required column strength. This plan was adopted and approved by the Philadelphia Bureau of Building Inspection.

To secure greatest economy, speed, and best working conditions, the concrete was cast on the columns in horizontal position in forms similar to those used for precasting piles. The forms were set on 6-14 in. timbers to provide a firm and straight casting platform and 2-in. planks were used transversely as decking. Over this, $\frac{3}{4}$-in. concrete, form-grade plywood was used for the bottom and for the sides of the form. Ordinary strap hinges were used on the outside of each form to open it up for removal of the completed column. The old columns were 8-in. deep sections with 8 in. flanges. To provide 4 in. of concrete cover, the outside of the fireproofing was made 16 x 16 in. Bent angles were used as a tie across the top of the form.

Columns not requiring reinforcing were wrapped with a light wire mesh. Where reinforcing was required, three 1-in. round bars were placed on the two open sides of the beam, with light mesh wrapped around the entire installation. Bars were tied in place; no bent steel was required and no welding.

Where anchor connections were to be made at the bottom of the columns the forms were arranged to leave the steel exposed and concrete was cast in place after the columns were erected. Gusset plates for diagonal bracing were extended to outside the fireproofing and the diagonal bracing was shortened to fit.

Central-mixed concrete, delivered in agitator trucks, was used for the fireproofing and reinforcement of the columns. A minimum strength of 3,000 psi. was specified and ordinary cement was used. The reinforced columns were lifted out of the forms



Old columns were fireproofed and reinforced in a single action by casting reinforced structural concrete around them, much as piles are cast.

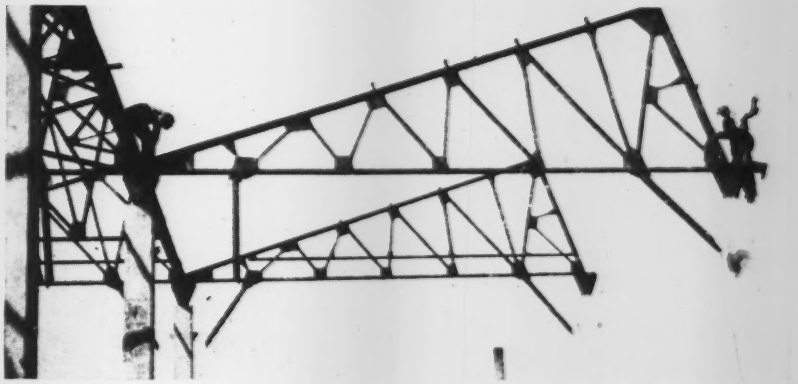
on the morning of the second day after pouring and, none showed any cracks from handling.

The 22-ft. 6-in. long columns with the fireproofing in place do not weigh more than 4 tons each, so erection was no problem for the moderate sized crawler crane on the work. Anchor bolts in the foundation held the columns erect while the trusses were re-erected in the position they occupied in the original structure. Some new steel was required, partly for a balcony that was not in the original structure, and for trusses for a short intermediate bay.

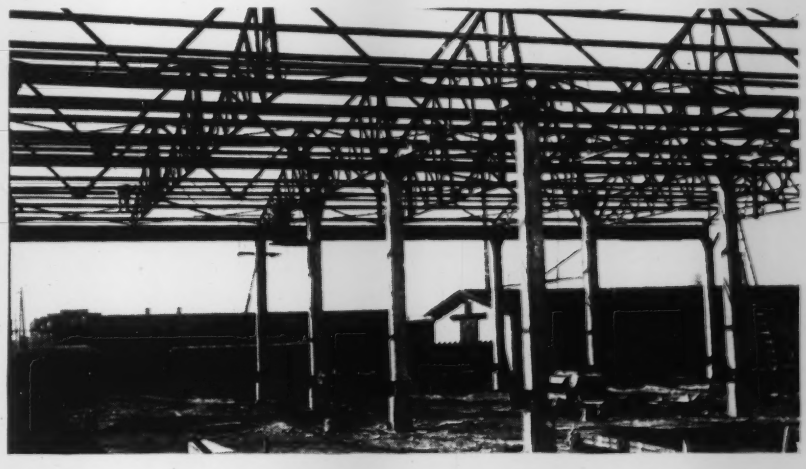
The old window sash of the monitors has been cleaned and reinstalled. The old sash came to the job with the glass left in it, but shipping and handling were very hard on the glass so that it is all being replaced. Old precast concrete roof slabs 24 x 52 in. are being reinstalled. The walls above poured foundations are new concrete block 12 or 17 in. thick.

Getting material that could be made readily available, rather than economy of construction, motivated the work on the old structure.

For Cuneo Press, Raymond G. Donato is in general charge of the construction work and Harry E. Ruban is the engineer. Robert E. Lamb & Son of Philadelphia are contractors on the work described, which has been done under the supervision of Walter Lamb, vice-president and James L. O'Marr, general superintendent.



Trusses are set in reinforced columns. Note connections for diagonal braces.



After the anchor bolts are tightened encasement of the columns will be completed with cast-in-place concrete.

Major Cities Modernize Building Codes

In several major cities building codes are being revised to help solve the housing shortage and to facilitate modern construction.

The American Society of Planning Officials observes that complete revision of building codes is long overdue in most big cities since they generally still cling to nineteenth century construction regulations.

Pittsburgh's recent adoption of a new building code makes it one of the few major U. S. cities to apply modern performance standards to construction control. Chicago is developing a new code also based on performance standards. So are Cleveland and Denver. Kansas City adopted a similar new code last year.

Performance standards permit use of new materials and construction methods as long as they withstand tests of wear, health and safety. At present specifications and standards limit construction to certain materials and building techniques many of which have been outmoded since codes were adopted decades ago.

The new Pittsburgh code was drafted by a mayor's committee and permits immediate use of any material or engineering method approved either by a board of standards and appeal, set up under the code, or by a recognized professional engineers' society. Plumbing is the only phase of construction not covered.

Inventors seeking approval of new building materials or techniques pay a $10 fee to cover costs of study and testing by the board of standards. The board serves without pay and will comprise a registered architect, a professional engineer and a contractor of at least 10 years experience.

Chicago's new building code is nearing first-draft completion. Officials hope to submit it to the city council in October. Like Pittsburgh's, the code is being based on performance rather than specification standards and presumably will provide for permanent construction of prefabricated housing as well as buildings using other new materials and engineering techniques.

Fig. 1. Trusses built on existing stiffening girder of Bronx-Whitestone Bridge have eliminated objectionable movements.

Widening and Stiffening Whitestone Bridge

E. L. Pavlo
Consulting Engineer, New York City
(Formerly, Chief Engineer, Madigan-Hyland)

Contents in Brief: *Widening each of the two separated roadways of Bronx-Whitestone Bridge by 3.3 ft. has changed them from two-lane to three-lane arteries at small expense so the bridge is now carrying up to 60,00 vehicles on peak days. Addition of a 14-ft. high truss to the 11-ft. stiffening girder has very substantially increased the stiffness of the structure against aerodynamic movement. Oscillations have been reduced from a maximum of about 18 in. noted before the truss stiffening to 9 in. observed since the work was completed last December.*

THE BRONX - WHITESTONE BRIDGE, over the East River near its confluence with Long Island Sound in New York, has recently been widened for greater traffic capacity and also stiffened to alleviate some objectionable oscillations observed on a few occasions in the 2,300-ft. suspended span. The bridge had a 27.5 ft. roadway in each direction; these have been widened 3.3 ft. by utilizing sidewalk space so that each now safely carries three lanes of traffic. Reduction of oscillation has been accomplished by adding a 14-ft. high truss on top of the existing deep girder which now becomes the bottom chord of a 25-ft. deep stiffening member. The suspension system has not been changed.

The Bronx-Whitestone Bridge was built in 1938-1939 by the Triborough Bridge Authority (now the Triborough Bridge and Tunnel Authority) headed by Robert Moses. The bridge is a most important connection between Queens and eastern Long Island and the Bronx and the mainland to the north and east. Traffic over the bridge has fully met prediction, and has rapidly increased since restrictions on motor vehicle use through the war years has been eliminated. The number of vehicles using the bridge from 1940 to 1946 is shown in the accompanying table.

Plans for the widening and stiffening of the bridge were made in 1941, but construction was deferred, because of war conditions, until the working season of 1946. Madigan-Hyland, engineers of New York City, were charged with the preparation of contract plans and specifications. O. H. Ammann, who handled the original design of the bridge, and Shortridge Hardesty were consulting engineers on the improvement.

Experience has shown that a 27.5 ft. width of roadway is more than ample for two lanes of traffic but insufficient to accommodate the three lanes of mixed traffic that increased peak-hour use demands. The practical way to increase the width was to take over the space occupied by pedestrian sidewalks, which have been little used.

Because of the existing restriction in the sidewalk width at the tower portals it was not possible to utilize the full width of the walk, but each side could be increased 3.3 ft. to provide a roadway almost 31 ft. wide for three lanes of traffic in each direction.

Widening the roadways required numerous structural alterations at the deck level; the existing sidewalks were removed, the railing barriers were disconnected, altered and reerected in the widened position; framing was added in the floor system to support the widened concrete slabs, and open grating to cover the remaining space of the former sidewalks was installed. In making the design and working out the details every effort was made to reuse the existing steel and to arrange the new connections so as to utilize existing rivet holes to the maximum extent possible.

Also, a number of improvements in existing details, suggested by J. E. Tonnelier, engineer of maintenance, were introduced to facilitate and to improve future maintenance. For example, in remodeling existing railing barriers, side drainage slots in the curbs were increased from 2½ to 5 in. high to facilitate snow removal.

Stiffening a psychological need

The bridge has a main span between towers of 2,300 ft., the fourth longest span in the world, with side spans of 735 ft. to concrete anchorages. The width between the 22-in. dia. main cables is 78 ft. The bridge is in an exposed location, high above surrounding land or structures; its roadway rises to 157 ft. above mean high tide.

Some oscillation of the suspended structure has been noticed since installation of the roadway deck was started during the construction period. The total movement up and down has been as much at 2 to 2½ ft. at the quarter-points of the span (with a maximum single amplitude of 18 in.)

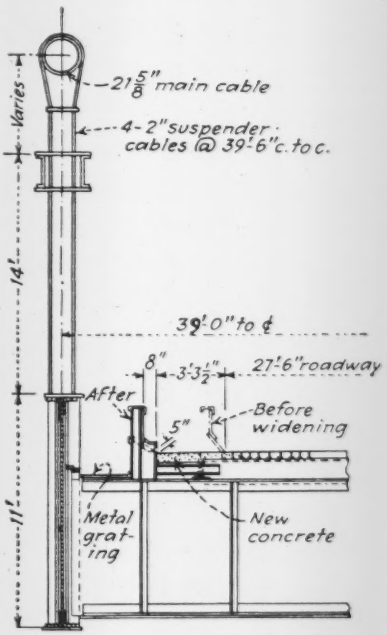


Fig. 2. The roadway was widened 3.3 ft. to provide adequate space for three lines of traffic.

Total movement in excess of 20 in. has occurred on an average of less than once a year while movement of 10 to 20 in. has been observed on an average of six times per year. Maximum oscillations have occurred from winds approaching the structure at an angle of 30 to 40 deg. with the bridge centerline and at a velocity of 25 to 40 mph. Movement under severe winds (up to 81 mph. in a hurricane in September, 1944) has seldom reached 10 in.

Such movement of a basically flexible structure of long span is believed to be entirely harmless and inconsequential so far as structural safety is concerned. However, experience has shown that under such movements users of the bridge experience some discomfort and, at one time, a few people became apprehensive.

Some diagonal cable ties and a friction dampener system installed at the towers, (*ENR*, December 5, 1940, vol. p. 750,) reduced the frequency of objectionable movement, but not its magnitude.

It appeared that correction of the movement required increasing the rigidity of the stiffening system, and a number of studies were made to determine the best method. The first plan was to add 25-ft. deep stiffening trusses on the inside of the existing girders, in the sidewalk space, and to have them work in parallel with the girders. This proved difficult to work in and around the existing floor steel and involved a complicated stress relationship with the existing stiffening girders.

A realization of inherent inadequacy of any parallel type of truss design led the writer to propose a composite girder-truss design consisting of an additional truss superimposed on top of the existing girder. In this way, the joint action of the two members could be assured and accomplished in the most efficient and economical way and in the same vertical plane. The original girder would then act as the bottom chord of the composite structure, and the new truss would provide the top chord and the necessary web members. This design was adopted.

Height of the additional truss was established at 14 ft. thus making the total height of the girder-truss 25 ft. As measured by the moment of inertia, the stiffness of this composite girder-truss was increased 650 percent maximum as compared to that of the original stiffening girders alone.

Details carefully made

Working out the general arrangement of the truss and connection details was of necessity controlled by the existing spacing of floorbeams and suspender panels with which it had to coincide. Truss verticals were located between the suspender points at the intermediate floorbeams, and the splices of the diagonals and top chord were established at the suspender points to permit efficient erection of truss sections. Side brackets were provided at all verticals to stiffen the top chord against lateral distortion. Typical design details of the added truss are indicated in Fig. 3. Openings are provided in the top cover plates to permit free passage of suspender cables through the box section of the top chord.

One of the conditions of the specifications was that the contractor should not fabricate steel until after a field survey determined the true line and grade of the existing girders. Girder elevations at panel points and accurate measurements of panel distances were made on three occasions at the ideal atmospheric conditions during the night when traffic was the

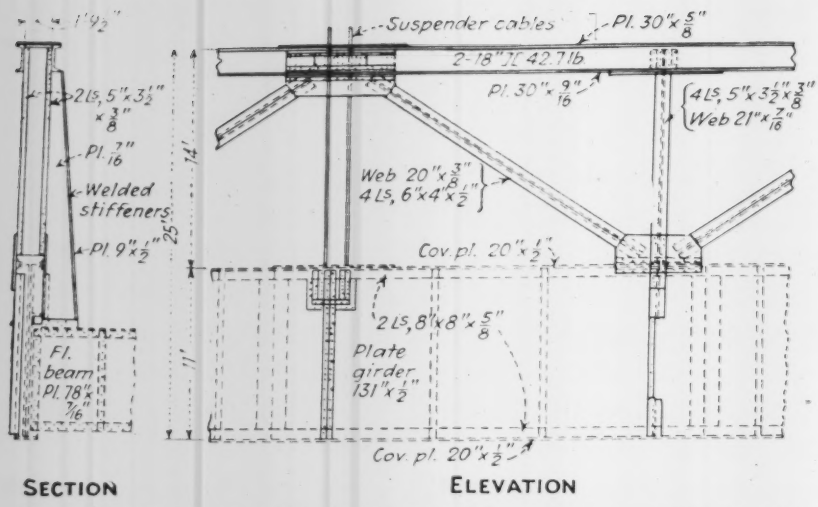


Fig. 3. Typical panel of side span with the stiffening truss riveted to the existing girder and a vertical stiffener carried on down to the floor beam.

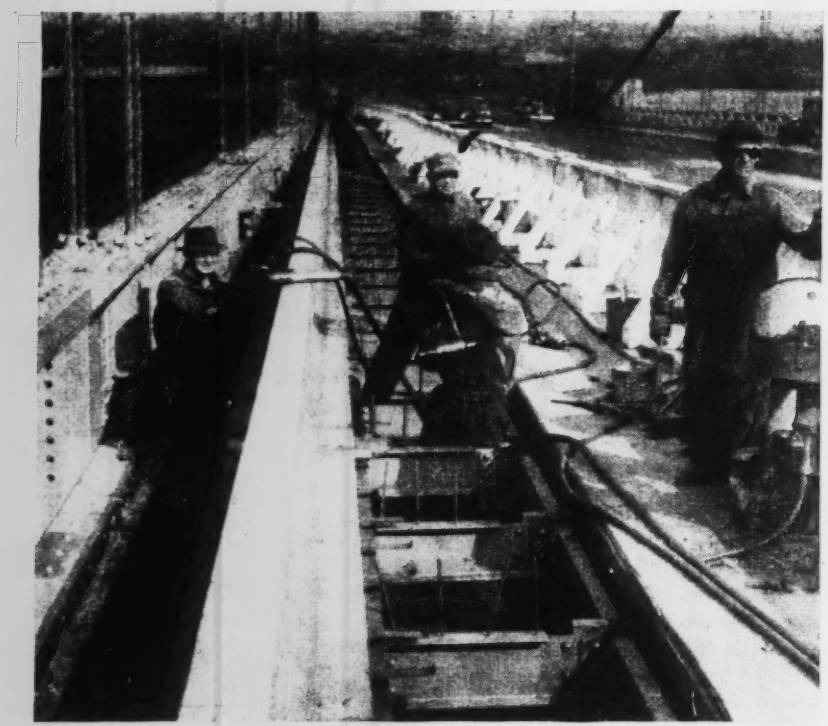


Fig. 4. Widened roadway is carried on extensions of existing cross beams at 5 ft. c. to c. Rods welded to the new steel were bent to embed them into the new concrete and thus provide a rigid connection.

least on the bridge. Foggy nights were selected for these survey operations in order to conduct the work during the period of least change in temperature. It may be noted that the structure moves $\frac{3}{4}$ in. up or down at the center of the main span for each degree Fahrenheit of change in temperature.

Results of the three surveys were closely coordinated and the actual profile of each girder was established upon which to base all other calculations to detail new construction. The actual shape deviated from the true theoretical parabola by an inch or so but variations were not uniform for the two girders. The fabrication of the individual members of the stiffening trusses was based upon the results of this survey.

Construction on the bridge was divided into two parts—Widening of the roadway and installation of the stiffening trusses. Existing sidewalk slabs were removed, then the existing side barriers disconnected and trucked to a local structural shop for remodeling. The remodeled barriers were installed in their new locations and the new floor steel, consisting of channels and I-beams, required for the support of the widening strip of roadway was framed in. The work was carried out symmetrically on both sides of the center to avoid unbalanced loading on the bridge.

Truck cranes do erection

Erection of the trusses followed closely the placing of the floor steel and the widening of the slab. The original plan was to start at the center of the span with two overhead travellers moving in opposite directions to load the structure symmetrically. The travellers were to span the full roadway width, allowing traffic to pass beneath them, while a single boom on each unit would set truss members on the stiffening girder symmetrically on each side of the bridge. A change in sequence of arrival of fabricated sections created the need for greater mobility of the contractor's equipment and truck cranes were used for erection.

Despite working from the roadway, two lanes of traffic in each direction were maintained practically all of the time. A heavy timber barricade, Fig. 4, protected both workmen and motorists.

Special care for cables

Vertical posts 12.5 ft. high, to set on top of the existing girder, came shop fabricated to a side bracket designed to extend on down to the floor-beam. Posts and diagonal members of the truss, with gussets attached, were set up, then pinned and bolted temporarily. Erection of the top chord sections required special manipulation and considerable rigging to avoid damage to the cables.

Each top chord section with its gusset plates and splice material extensions was about 3 ft. 6 in. longer than the panel length between suspender cables. The forked end of the top chord

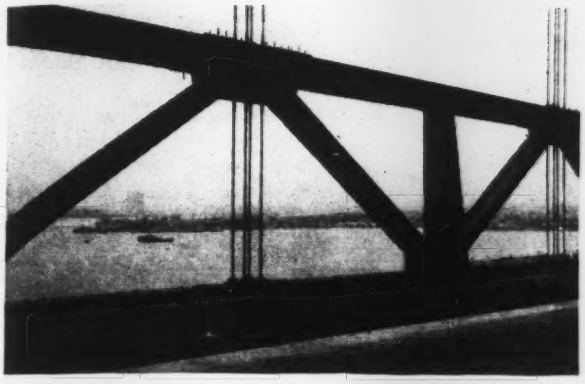


Fig. 5. Vertical posts, diagonals and top chord members were shop assembled. In the field, posts, diagonals and chord members were erected in that order then joints pinned and bolted as the holes lined up.

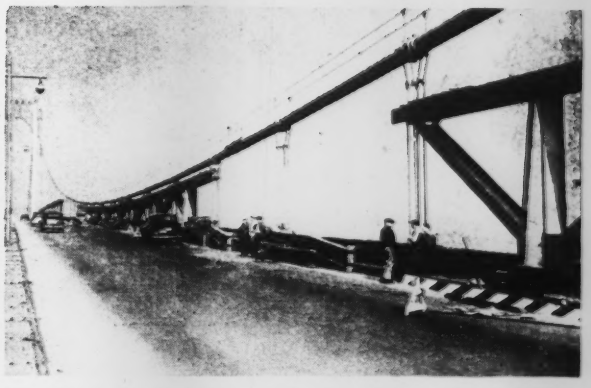


Fig. 6. Special care was necessary in installing the new steel where the main cable dips to near the girder at the center of the bridge. Suspender and main cables were protected from gouging with burlap and soft wood.

was swung past the suspender cables and then the end tilted to get it into position, and to fit the gusset plates and splice material into the corresponding construction of the preceding chord member. Precautions were taken to avoid any possible contact with the suspenders or the main cable during erection by use of soft wood attached inside the gusset plates, burlapping at points of critical clearance, and the like. While the adopted method of erection of top chords required considerable rigging and special care in handling all members, the contractor found it more expedient to shop rivet most of the splice material to the main members than to assemble in the field.

The erector so arranged the fastening of gusset plates and connecting angles as to permit the individual members to square-up as the fitting and bolting proceeded. In no instance did the erector force the pinning and bolting of the members. Where rivet holes did not match perfectly, as installed, under-size bolts were used; in extreme cases, ½-in. bolts in 1-in. holes. As erection proceeded and additional weight was placed on the bridge, accompanied by temperature changes, all holes gradually became concentric and were then immediately fastened with full size pins and bolts.

After six to eight panels had been completely fitted with full size pins and bolts, the lower gusset connections of diagonals and posts as well as the connection to the stiffening girder were riveted up. After these connections were completed the top chord splices and diagonal connections were riveted.

Trusses at the center of the bridge, where the cables came down to within a few feet of the original girder were planned and detailed to be erected first, but due to delays in delivery of steel had to be placed last. Particular care was exercised in making the last panels fit without forcing. For the last of them, loaded trucks were shifted to produce a slight local movement to make the rivet holes match without forcing or reaming.

Results accomplished

Since the installation of the roadway widening, the traffic conditions on the bridge have noticeably improved. Three lanes of mixed traffic can now be readily accommodated in each direction. Thus the traffic capacity of the bridge has been materially increased at peak hours at comparatively small expense.

The addition of stiffening trusses has likewise produced beneficial results. Observations of the bridge movements have been carried out daily by means of a level instrument permanently located at one of the towers. In general, two separate effects have been observed. Local deflections and vibrations between suspender points, due to the passage of heavy loads, have been reduced to a negligible amount.

So far as bridge movements or undulations due to adverse wind conditions are concerned, measurements indicate a considerable improvement as compared to previous behavior. Late in March, 1947, on two days of particularly strong and gusty winds from the northwesterly direction, approaching a velocity of 30 to 40 mph., the maximum vertical movements were 7 to 9 in. No discomfort was experienced, and traffic moved along in a normal fashion. Under similar wind conditions, before the stiffening trusses were added to the structure, the bridge movements were in the maximum range previously noted.

It may be stated in conclusion that the stiffening trusses provide the additional measure of rigidity anticipated in the design.

The work was performed by the Woodcrest Construction Co. of New York City, as general contractor. Fabrication of the new steel was done by the Pittsburgh-Des Moines Steel Co. and the American Bridge Co. Louis Balog of New York City was consultant for the Pittsburgh-Des Moines Steel Co., performing the surveys and calculations for truss fabrication. Erection of steel was performed by the Fichter Steel Corp. of New York City, under the direction and supervision of S. Kapelsohn. H. W. Knox was resident engineer for Madigan-Hyland, with the writer in over-all charge of the project.

VEHICLES CROSSING BRONX-WHITESTONE BRIDGE

Year	No. of Vehicles
1940	6,363,442
1941	6,829,545
1942	5,049,412
1943	3,236,485
1944	4,248,770
1945	5,194,703
1946	8,604,991

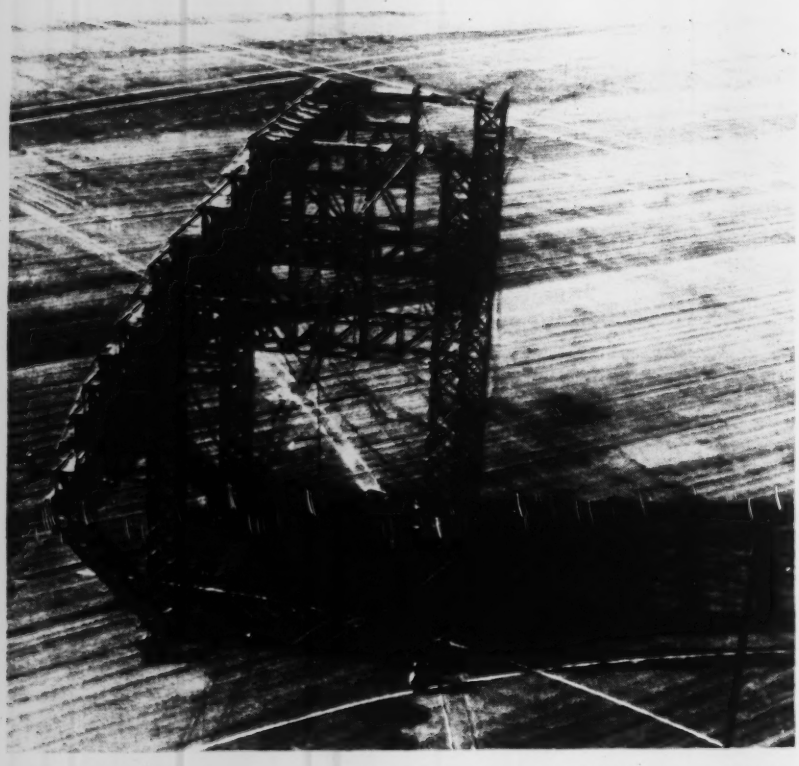
Scaffold Makes Faster Moves on Third and Fourth Blimp Docks

THE MOVABLE SCAFFOLD that made such progress in "restrengthening" two of the Navy's blimp docks at Moffett Field last year not only surpassed that record on a later job at another air station but also withstood the racking of a long-distance move. Despite the unusually light construction for a scaffold 145 ft. high and the small diameter of truck wheels, this structure made a move of about one mile in less than an hour and three-quarters. The operation at Moffett Field, where the scaffold was built, was described in *Engineering News-Record* Feb. 6, 1947, vol. p. 204. The move on the next job, at the Santa Ana naval air station in southern California, is described in the following.

Upon completion of the work at Moffett Field the traveler was dismantled and loaded into seven gondola cars for rail shipment to Santa Ana. The dismantling for shipment was greatly facilitated by the fact that this procedure was contemplated in the original design and when the structure was built, bolted joints were used in locations such that the frame could be dismantled in sections. These sections were as large as it would be convenient to handle in the ordinary gondola cars.

For example, in the framing of the towers, which are 6x6 ft. in horizontal section, and are located at the four corners of the scaffold, the framing in an opposite pair of the four faces was nailed rigidly. Thus two permanently jointed panels were in opposite sides of the tower. The other two sides, connecting these permanent faces, consisted of members bolted in place as were the girts and diagonals. Similar arrangement of connections was made in the framed struts. When time for dismantling came it was only necessary to remove bolts and lift out flat panels. Platform trusses and transverse trusses were put together with bolts at the chord splices so that the maximum length did not exceed 45 ft. Before dismantling began, match marks were put on throughout to preclude confusion or interchange of like members in reassembly. As was expected, some breakage occurred during the handling and damaged members were replaced in the process of reassembly.

The work to be done in the blimp docks at Santa Ana, which the Navy refers to as "restrengthening," was of much the same general nature as at Moffett Field. It includes putting angle clamps on split members, an occasional stitch bolt and a great amount of bolt tightening. The work on the Santa Ana docks was roughly three times as great in quantity as at Moffett.



Tall scaffold on the move after height was reduced to 120 ft. Truck at lower left edge is the tow car. Braking truck stands by in the rear. Two groups of men at forward corners are guiding the house-movers trucks.

Scaffold moved around the field

Upon completion of work in the first Santa Ana hangar, the top 25 ft. of the scaffold, which includes the cantilever trusses and 18 ft. of the tower, was removed in order that the rig could move out under the box girder over the blimp dock door. This door affords only a 120-ft. clear height.

Once outside the hangar there was the problem of getting the scaffold to the next dock on which similar work had to be done. Unlike the arrangement at Moffett Field where the two blimp docks are close together, the docks at Santa Ana are on opposite sides of the field. In order to avoid interference with field operations it was necessary to move the traveler a total distance of about a mile around the end of a runway and back across the airfield to the other dock.

As it was desirable to avoid exposing the scaffold to any more wind than necessary, the move was started at 6 o'clock in the morning, when the air is usually quiet. Motive power for the towing job was provided by a 3-ton truck and a 6-ton truck was in attendance to hold back if braking became necessary after the scaffold was moving. This was thought advisable because of a slight downgrade in the direction of travel and the possibility of a tail wind.

As it happened, the weather forecast on the day before indicated there might be a 10-mph. cross-wind dur-

ing the move. To offset this the contractor used a ballast load of 40 kegs of nails, 20 kegs on each of the upwind corners of the scaffold. As an additional safeguard a 20-ton truck crane stood by ready to anchor down one end of a guy line which had been attached near the top of the scaffold to serve as an emergency anchor against wind. The truck crane was used because it had pneumatic tires which could operate over paved areas. Otherwise a tractor would have served equally well as a movable anchor.

During the move it developed that none of these three precautions was essential. The frictional resistance in the trucks supporting the scaffold was sufficient to prevent any tendency to "run away" and the guy line for a wind anchor was not used.

For about one-third of the mile that the scaffold had to be moved it was towed ahead on easy curves which were followed smoothly by having two men guide the tongue from the forward wheels of the trucks under the scaffold. The tongues were pulled one way or another in accord with (1) signals from the foreman and (2) visible indications of transverse stress in the solid rubber tires carrying the weight of the scaffold. Whenever the towing lines tended to twist the scaffold, the tire showed unmistakably the tendency to pull sidewise. This was always relieved by slightly swinging the tongue in the direction indicated.

The scaffold was thus towed to a position beyond the end of the runway which had to be kept clear. At that point the direction of travel was reversed and it was towed in the opposite direction after removing the towing bridle, attaching it to the opposite end and similarly transferring the tongues in the trucks beneath the scaffold. These trucks were in all respects reversible.

This reversal in direction of travel was made instead of swinging around an easy curve because the sequence of work, as the job was laid out in the two docks, called for the scaffold to be facing in the opposite direction when it started operations in the second dock. The move from one dock to another was completed without mishap in 1 hr. and 40 min.

As noted in the previous article, the length of platforms on the traveler is such as to permit work to be done on four half-arch trusses simultaneously, thus requiring thirteen moves down each side of the 52-arch dock. At Santa Ana the crew not only averaged about two moves per day (nine hours) as against about one and one-half at Moffett Field, but on one day accomplished three moves of the scaffold. On completion of the work at Santa Ana the scaffold was again dismantled and stored for possible future use by the Navy.

The restrengthening program at Santa Ana was under the direction of Comdr. W. J. Williams, CEC, USN. The work was done by J. H. Pomeroy & Co., Inc.; J. R. MacDonald was project manager.

Durability of Masonry Paints Investigated by Bureau of Standards

Well-formulated masonry paints skillfully applied are durable, according to Technical Report 1115 of the National Bureau of Standards, Washington 25, D. C., based on exposure tests extending over a 6-year period.

For cement-water paints, the method of application, curing and conditions under which surfaces are painted were found to be more important than the composition of the paints as long as the portland-cement content of the paint is not less than 65 percent by weight. With the possible exception of concrete cast against oiled forms, cement-water paints are satisfactory for the initial painting of new masonry.

Further coatings are not necessary although for improved decorative value, the cement coating can be covered wth an exterior masonry oil-base, resin-emulsion or rubber-solution paint. A synthetic-rubber paint can be applied immediately after the cement-water paint dries, but it is recommended that the latter be permitted to age for at least two weeks before application of resin-emulsion paints and three months before application of oil-base paints.

Sharp sand in the cement-water paint or a priming coat of grout improves the durability of subsequent organic coatings on open-textured walls or those having cracks or other defects. Pure white portland cement or admixtures of cement and lime will also give good results, according to the report.

On close-textured masonry or open-textured surfaces that have been moisture-proofed, oil-base paints can be used, although new surfaces of both types should not be painted for 6 to 12 months. Walls must be dry when the paint is applied and so constructed as to remain dry after painting. Applied to a wet wall or one that becomes wet through structural defects, these coatings will fail by scaling and flaking. Oil-base paints usually weather by chalking, a property that makes them self-cleaning and lessens their tendency to discolor or stain.

A grout of portland cement and sharp sand gives a good base coat on open-textured surfaces such as stone- and cinder-concrete block, lightweight aggregate-concrete block, and new and used common brick with untooled joints. The grout should be allowed to set at least 90 days. It may be applied immediately upon erection of the wall or at any time during the aging period of 6 to 12 months.

A protective primer, such as rubber-solution paint, should be used as a first coat over the grout if there is a possibility that the wall is damp or contains soluble salts. One coat of an oil-base paint should give a good finish, although two coats will have greater durability.

Resin-emulsion paints have good decorative qualities and are durable on exterior masonry walls. Open-textured surfaces and brick walls with cracks around the mortar joints should be given a base coat of grout or cement-water paint containing sharp sand.

Synthetic-rubber paints come in two types: rubber-emulsion and rubber-solution. They may be applied on either dry or slightly damp wall surfaces but not on wet surfaces, as excessive moisture may prevent adequate bond. The rubber-emulsion paint samples tested by bureau scientists were received directly from the manufacturer and represented experimental mixes. They are not available commercially.

RESEARCH LABORATORIES OF THE RECLAMATION BUREAU—PART II.

Selection of Construction Materials

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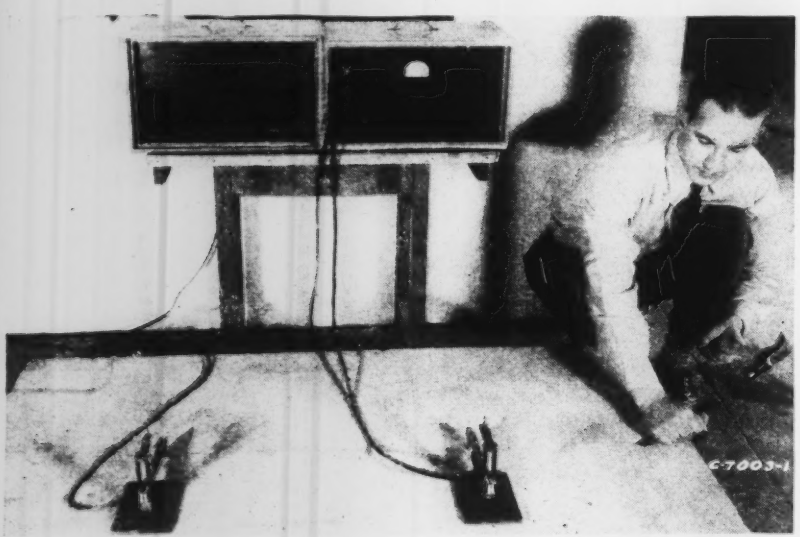
***Contents in Brief**—Laboratory testing and field research techniques of the Reclamation laboratories have been developed to the point where complete evaluation of materials can be made on a functional, quantitative and economic basis. Consequently determinations are made with regard to processing and construction requirements as well as in connection with methods of use. Aggregates and cements for concrete, earth materials, metals and protective coatings come under this preview. Compilation of manuals and training courses aid in the dissemination and use of new technical knowledge. A preceding article in the series (Sept. 18, vol. p. 380) outlined the organization, and broad objectives of the laboratories.*

SINCE the establishment of the central engineering laboratories of the Bureau of Reclamation 17 years ago, they have played a vital role in the selection and use of materials employed in projects involving some 30,000,000 cu. yd. of concrete, 70,000,000 cu. yd. of compacted earth embankment, 625,000 tons of metal, and substantial quantities of protective coatings, grout, plaster, cork, rubber and miscellaneous products.

How the laboratories function to insure that the best available materials are selected for a given purpose and that those materials are used to best advantage, is the purpose of this article.

As would be expected, materials produced in relatively large quantities from natural sources at or near the construction site, such as concrete aggregates, pozzolans, earth materials, and riprap, claim prominent attention. Those from promising deposits are tested and sources selected for use that provide satisfactory quality at lowest possible cost. Such investigations constitute an initial phase in what might be termed the control of quality of the structures. Further tests and studies are made to determine processing and construction requirements, and finally, the laboratory engineer is called upon to solve special problems that arise in connection with the use of the materials.

Materials embracing those supplied by manufacturers in finished form—such as portland cements, metals, protective coatings, sealing compounds and joint fillers—constitute another broad program of investigation. Laboratory control does not stop with determination of acceptability of the finished materials. Through well-directed research, defects are compensated or means for their elimination are devised, new uses are developed, and improved methods of use are determined. Typical developments resulting from this research are to be discussed in an article appearing later in this series.



Bureau of Reclamation Photos

Fig. 1. With this laboratory-developed electronic apparatus the modulus of elasticity of concrete in place can be determined by measuring the velocity of a sound wave, set up by a hammer blow, as the wave passes the two pick-ups.

Aggregates under the microscope

Reclamation structures often are built in an area where there has been no systematic search for or development of sources of concrete aggregates, and where service records of concrete made with local aggregates are not available. Thus the control of aggregate must be based on the findings of the materials engineer and the geologist in the field and in the laboratory.

In addition to the usual acceptance tests, aggregates are examined under

a microscope by petrographers who indicate the necessity for making additional tests to determine its suitability for use in concrete. For example, a quarried gabbro from the Yamhill project, Oregon, passed all acceptance tests for soundness, but microscopic examination of the rock showed that a claylike alteration product occurred interstitially in large quantities.

Further tests proved this rock to be susceptible to large volume changes with wetting and drying, and concrete beams containing the crushed gabbro as aggregate were characterized by excessive drying shrinkage and very low freezing and thawing durability. The quarry was rejected as a source for concrete aggregate.

Another illustration: Chemically unstable minerals are not detected by standard tests, but such deleterious substances as gypsum, sulfides, or alkali-reactive compounds may be discovered under the microscope. Coatings of gypsum were identified on natural aggregate proposed for use on the Boulder Canyon project by microscopic examination and as a result, plant-processing methods that would efficiently remove the gypsum were specified.

Alkalies and aggregates

When petrographic analysis indicates aggregates have reactive tendencies with the alkalies in the cement that contribute to disruptive cracking in the concrete, they are tested in concrete to determine whether this characteristic is critical. Rocks and minerals known to be susceptible to alkali reaction are: Opal, many volcanic rocks of acid to intermediate composition (high to medium silica content); glass (artificial or natural, excluding the basic types such as basaltic glass); chalcedonic rocks (including many cherts and flints); some phyllites; and tridymite.

The most promising aggregate deposit is fully explored by test holes, and additional tests are made to determine the behavior of the aggregate in concrete and to obtain information, for design purposes, on strength, temperature rise, durability, creep under load, elastic properties, volume change, and permeability. Sometimes the aggregate from the best nearby deposit is lacking in quality or in other respects, and the laboratories must determine what can be done to improve the material or the concrete in which it is used.

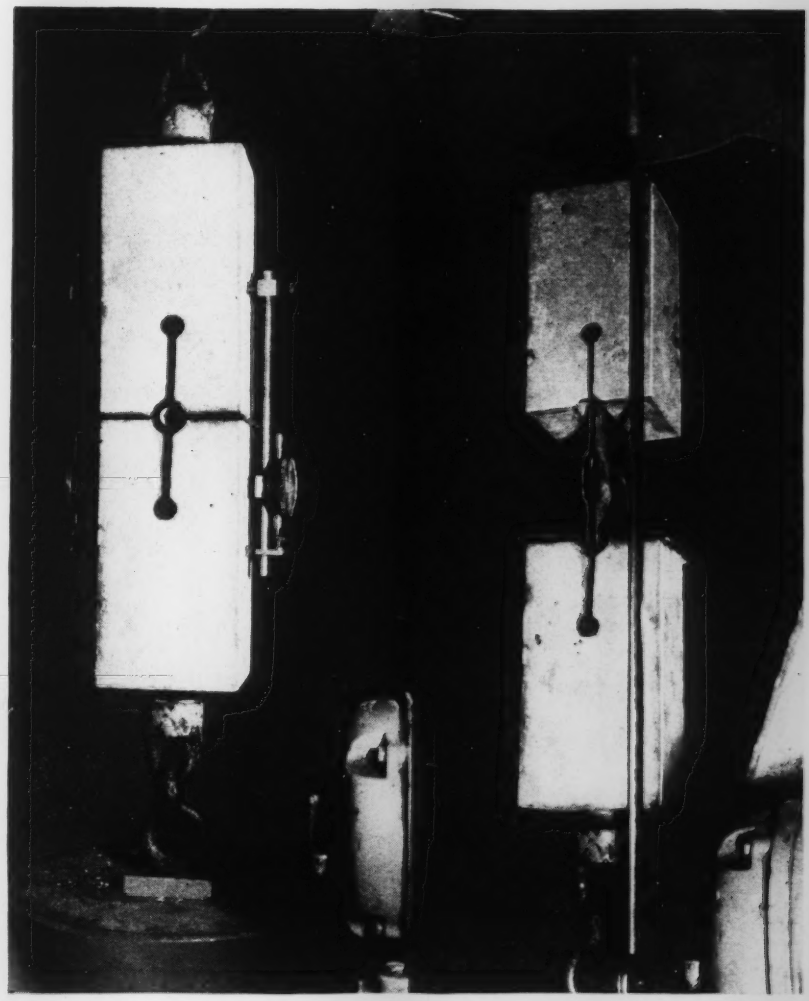


Fig. 2. Test setup for a rubber-bulb seal in a concrete joint. The right-hand photo shows that seal was effective after an elongation of 6 in.

Thus, the most economical deposit from the standpoint of transportation for the 630,000 cu. yd. of concrete in Davis Dam and appurtenant structures was selected for use, although it has certain undesirable characteristics. Portions of the deposit containing objectionable coated material will be wasted. Petrographic examination showed the presence of material known to be reactive with the alkalies in the cement, which indicated that low-alkali cement would be needed. However, subsequent mortar-bar tests showed expansion, even with cement having alkali contents as low as the usual specified limit of 0.6 of one percent.

In view of the disruptive damage caused by alkali-aggregate reaction in the nearby Parker, Copper Basin, and Gene Wash Dams, it was evident that some additional means must be devised in order to assure soundness of the structure. It was found that cement available within reasonable shipping distance did not have an alkali content as low as desired. However, as a result of laboratory tests, it was decided to employ a pozzolanic material obtainable from sources near the California coast which will satisfactorily counteract alkali-aggregate reaction.

It should be noted that the use of pozzolans is often advantageous from standpoints other than that of preventing disruptive expansion in concrete. Pumicites, tuffs, shales, and

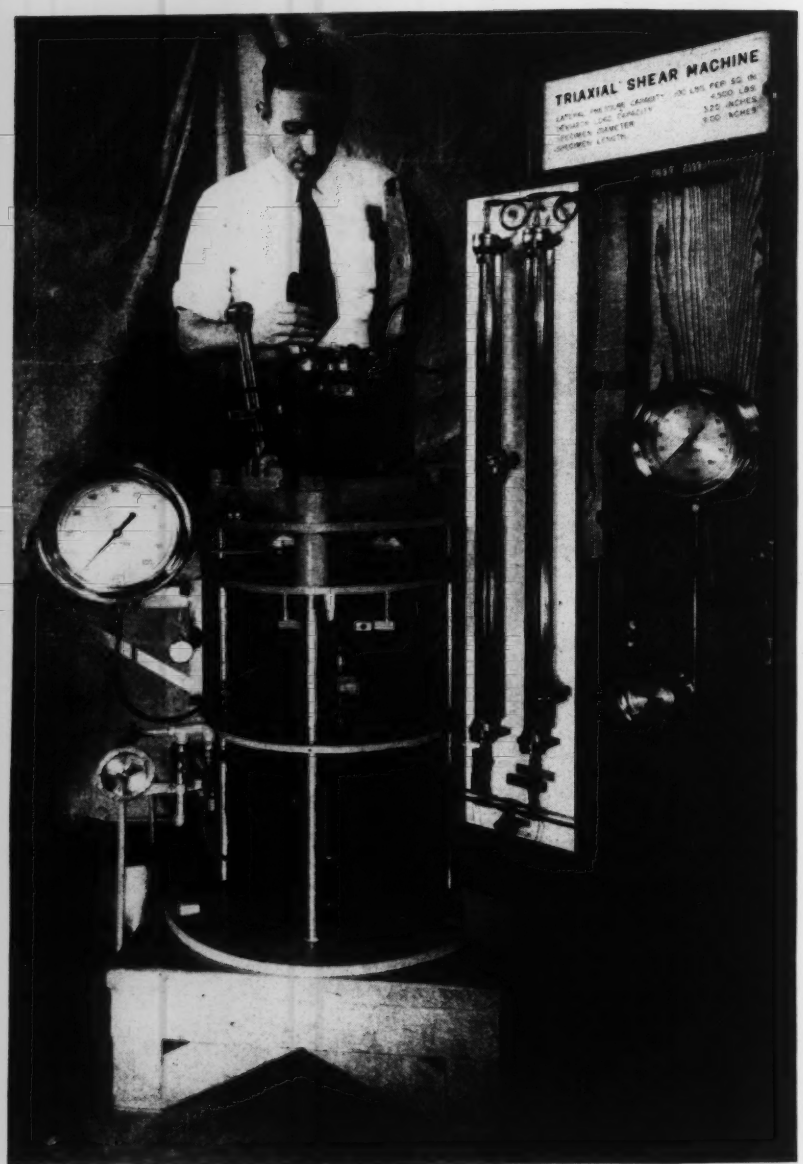


Fig. 3. Machine for a three-way "squeeze". This triaxial shear machine, designed and built by the bureau, is used in determining the angle of friction and the cohesion of soils. The specimen to be tested is placed in the pressure chamber near the top of the apparatus where both vertical and lateral pressures can be applied and the pore pressure within the rubber encased specimen can be measured.

other pozzolanic materials sometimes can be found in the vicinity of the sites for proposed large concrete dams. These possess cementitious properties when used to replace part of the cement in concrete mixes. Their use often permits a saving in cement, with reduced heat generation in the concrete and improved workability. Pozzolanic materials were used by the bureau in Friant Dam in California and Altus Dam in Oklahoma.

For large concrete dams, use of cement having low heat of hydration is important. Therefore, investigations of concrete include complete tests under conditions simulating those occurring within massive structures. Test specimens are hermetically sealed and cured under rising temperatures created by generation of heat by the hydrating cement. Low-heat cement, originally developed for use in Hoover Dam, has since been employed in the construction of Shasta and Grand Coulee Dams and six other large bureau structures.

Entrapment of heat of hydration in a massive concrete structure gives rise to complicated design problems and often necessitates removal of part of the heat by artificial cooling. Proper design of cooling systems involves computation of heat-flow and heat-release, which, in turn, depends on determination by the laboratories of the thermal properties of the concrete. The properties are influenced markedly by the nature of the aggregate, the temperature rise resulting from hydration of the cement, and the mix proportions.

The laboratories make many tests in connection with the use of materials. Typical are the large-scale grouting tests made to investigate the effect of fineness of cement, water-cement ratio and pump pressure on the flow of grout into vertical contraction joints of concrete dams and on the shearing strength of the resulting joint.

These tests showed that coarse particles in the cement obstructed the flow of grout in these narrow joints, that a joint opening of less than 0.003 in. could not be successfully grouted with cement all of which passed a 200-mesh sieve, and that the ability of completely grouted joints to transmit shearing stresses ranged from 30 to 100 percent of the unjointed concrete.

The soils, foundation materials, and groundwaters in many locations throughout the West contain sulfate salts in concentrations that are inimical to concrete made with ordinary cement. Where such conditions are encountered, samples are chemically analyzed and destructive effects estimated from observation of structures in service and from experimental data accumulated from laboratory tests. The laboratories also develop protective coatings and impregnating substances to protect concrete against extremely severe exposure to sulfate attack.

Policy on admixtures

At this time, use of admixtures in concrete by the bureau is almost entirely confined to accelerators for developing early strength during cold weather placing and air-entraining agents, of which the latter materials largely predominate. Air-entraining agents are used primarily to improve

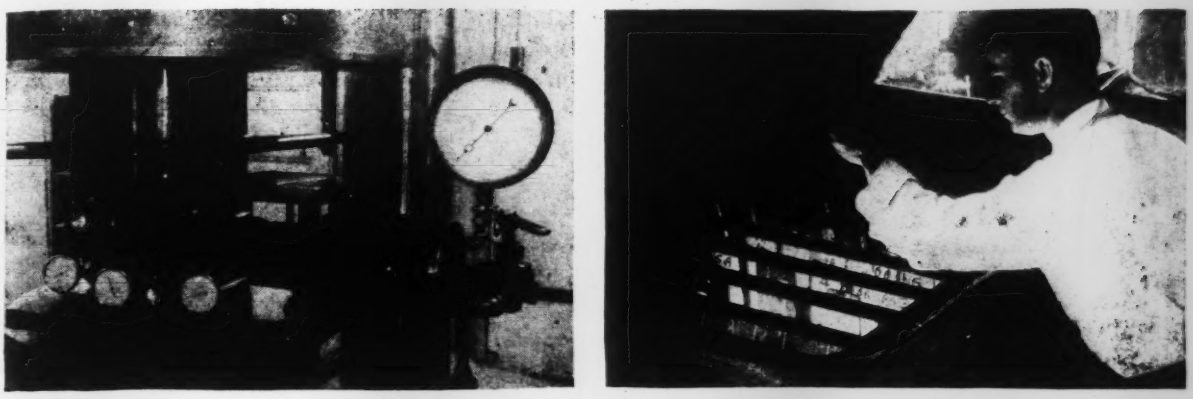


Fig. 4. At the left is shown the manner by which rollers for the large gates at Shasta Dam were tested for rolling friction under loads up to 1,200,000 lb. At the right is an automatically controlled salt-spray cabinet for testing corrosion resistance of metals and various types of coatings for outdoor structures.

the resistance of concrete to freezing and thawing, but their use is frequently approved or specified because they afford an inexpensive and effective means for increasing workability. Detailed instructions are issued by the laboratories for guidance of construction forces in the use of these materials.

Tests reveal that optimum durability of concrete is obtained with an air content of around 6 percent and there is apparently no advantage in exceeding this amount because the strength and abrasion resistance of the concrete is usually reduced as the air content is increased, and the drying shrinkage is increased for air contents above 6 percent.

The percentages of entrained air on bureau structures varies depending on the amount of mortar in the mix. Concrete containing 6-in. maximum aggregate, and which usually contains less mortar than concrete with 1½-in. maximum aggregate, requires a corresponding less amount of entrained air for the same improvement in durability.

Earth-embankment studies

Samples of earth embankment materials are tested to determine their standard properties, such as the proportions of sand, silt, gravel, and clay, and the density to which the materials may be compacted as well as their permeability characteristics.

The samples obtained during the later stages of investigation are tested in greater detail. Shearing strength, stability, and tendency to settle and consolidate under anticipated conditions of service are determined; special characteristics, such as swelling tendencies and chemical compositions, may also be analyzed. To the designers of earth dams and embankments such data are invaluable in determining the components and configurations of the structures.

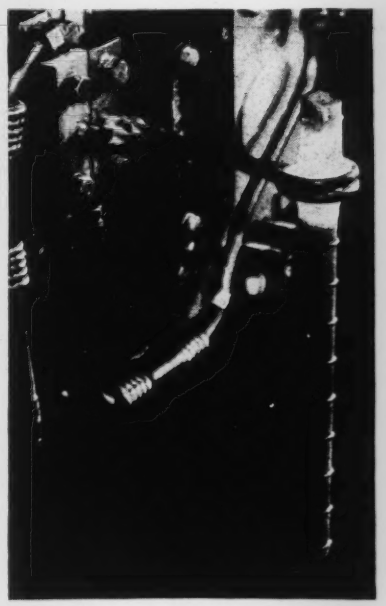


Fig. 5. High frequency induction heating gives promise of effective application to pressure welding of reinforcement bars.

Articles In This Series

The organization, objectives and techniques of the Engineering Laboratories of the Bureau of Reclamation are outlined in six articles, of which this is the second. The series includes:

Tools for Better Engineering
Selection of Construction Materials
What the Engineering Geologist Does
Solving Field and Office Problems
Operating and Maintenance Studies
Looking Ahead to New Developments.

To improve the understanding of soil mechanics principles, research tests are constantly being performed on earth materials. The use of these materials for construction purposes is also determined. For example, it is often assumed that a soil should be placed at maximum density and optimum moisture conditions to obtain the most stable embankment, regardless of the height of the structure.

With the advent of high earth dams, laboratory investigations showed that the soil to be placed at a considerable depth in the embankment should be compacted somewhat on the dry side of optimum moisture so that excessive pore pressure will not develop when the mass consolidates from the overlying weight of the structure.

Therefore, before a high earth dam is constructed, such as Anderson Ranch Dam in Idaho which extends 456 ft. above bedrock, a series of consolidation and pore pressure tests are conducted. From the tests a series of limiting placement moisture curves are prepared for the materials to be used. The curves show the placement moisture limits for different fill pressures and include a lower moisture limit, based on zero consolidation upon saturation, and an upper moisture limit, based on a 20 per-

cent pore pressure development from consolidation.

These placement moisture limits are used to control the construction operations, and are also a direct aid to the designer because basic design assumptions pertaining to consolidation and pore pressure can be adopted.

Metals and protective coatings

To aid in the design of valves, penstocks, gate hoists, and turbines, tests are made in the laboratory to enable the best selection of the types and grades of metal for use in their fabrication. The strength, elasticity, hardness, and brittleness of welds are investigated; also the residual stresses caused by welding.

Friction tests on combinations of metals used in gate rollers and bearings are made, often on full-scale parts, and under loads of several million pounds. Laboratory studies of types and combinations of metals proposed for use in gates have prevented use of metals which would be affected by galvanic corrosion. As new alloys are suggested for use, bureau designers are provided with factual data on characteristics and suitability.

Stainless steel, spring brass and bronze have been used in spring seals along the edge of some large spillway drum gates. Recent load-deflection and flexure fatigue tests made on these and other metals indicated that the service life of spring seals would be increased materially if beryllium copper were used.

The technical control of the types and qualities of protective coatings used on operating equipment and structures is an important function of the engineering laboratories. Outstanding in this respect is the painting of metalwork. Gates, trashracks, penstocks, pipe lines, bridges, and miscellaneous metalwork installed each year constitute a large tonnage of steel subjected to severe exposure to moisture and sunlight which must be effectively protected from corrosion.

The laboratories watch new developments by manufacturers of protective coatings, particularly those having to do with basic ingredients and procedures for surface preparation and application. Of greatest concern, at present, is the coating of submerged and partly submerged metalwork, for which large use is made of specially adapted coal-tar pitch coatings, particularly coal-tar enamel. Advantageous use is also made of resin-base coatings such as phenolics, alkyds, and vinyls. Laboratory investigations give promise that hot-sprayed plastics and synthetic rubbers will find useful places in bureau work, not only as protection against exposure but also as a means of reducing pitting caused by cavitation.

A great variety of other materials

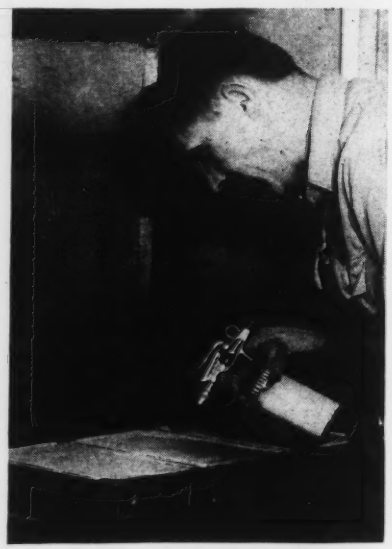


Fig. 6. Sealing ability of concrete curing compound is determined by measuring moisture loss from coated concrete specimens shown in the pans.

are used in bureau construction. Riprap is obtained from a rock source which, as a first consideration, is so bedded and jointed that it will yield stones of suitable size. This having been assured as the result of geological field investigations, samples of the proposed rock are tested in the laboratory to ascertain if it provides adequate resistance to freezing and thawing and will satisfactorily withstand the abrasive effects of handling and wave action.

Tests of bentonite

Bentonite is tested to determine whether it will swell sufficiently when moistened to be effective as an impervious canal lining or is suitable for use in grouting leaky reservoirs. Tests have shown that bentonite in its unexpanded state can be pumped into channels of flowing water by mixing it with kerosene or other petroleum products. The bentonite in such a mixture expands shortly after coming in contact with the water, and the full advantage of the expansive properties of the bentonite can be realized for sealing off the flow.

All the details involved in the control of quality and use of construction materials cannot appropriately be included in specifications. The bureau therefore issues to its engineers in the field comprehensive instructions, advice and information in the form of manuals which includes the knowledge gained from field experience and laboratory tests coupled with research findings.

The *Concrete Manual*, of which a fifth edition is in preparation, was initiated ten years ago by the laboratories. Each edition has been revised to bring it up-to-date, and new developments which occur between editions are covered by supplemental instructions which are distributed to the projects.

New reports being prepared

Other manuals, covering field and laboratory investigations of materials, geological procedures, field permeability and groundwater measurements, paints and painting, and measurement of irrigation water, have been or are being prepared by the laboratories.

The ultimate objective of the engineering laboratories is to assure the production of durable, safe and serviceable structures at the lowest possible cost. This can be accomplished only when those responsible for the supervision of the work on the many bureau projects have a uniform understanding of the technical considerations essential to effective construction control.

To this end during the past ten years the laboratories have carried on well-organized training courses for field engineers. The training courses are also valuable because they permit an interchange of ideas between the field and laboratory and keep the laboratory forces in closer contact with the problems of construction.

The next article in this series will tell how geologic and related investigations of site conditions are carried out and related to design.

From Field and Office

WORKING PROBLEMS AND TIME-SAVING METHODS FOR ENGINEERS AND CONTRACTORS

Information About Nails

Nails driven in holes $\frac{1}{32}$ to $\frac{1}{16}$ in. smaller than the diameter of the nail will have considerable greater resistance to pull and shear than nails driven without holes. Cement coated nails are considerably superior to uncoated nails. The length of nails for best service should be somewhat more than twice the thickness of the member holding the heads. Slender nails will hold better than thick nails under repeated shocks and constant weaving action, because they bend without losing their grip at the point. The best results in holding power are given by nails with a short pyramidal point. Either blunt or sharp point reduces this holding power. If a cut nail is driven with the taper sides parallel to the fibers of the wood, the resistance to withdrawal is greater than when driven in the usual manner, but it is more liable to split.—

THOMAS H. MCKAIG
Consulting Architectural Engineer
Buffalo, N. Y.

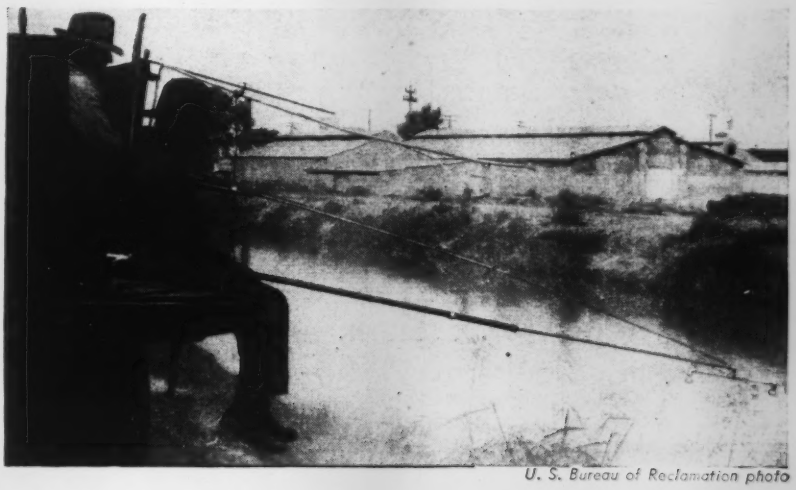
Roller Straight Edge To Test Pavement Surface

A light-weight portable device known as a "roller straight edge" has recently been constructed by the Division of Tests of the Virginia State Highway Department. It consists of an aluminum I-beam mounted on three small rubber-tired wheels. The end wheels are spaced 10 ft. apart and rigidly attached to the frame; the center roller is free to move up or down according to surface irregularities.

Amount of deviation from a straight line is shown on an exaggerated scale. In addition, an electric buzzer is attached and can be adjusted so that the operator is warned if the deviation in the 10-ft. distance is greater than the tolerance permitted.

Plans for the "roller straight edge" came from the Ohio Department of Highways and some improvements were incorporated.—R. E. Steele, *Department of Highways, Richmond, Va.*

BANK WEEDS SPRAYED FROM MOBILE UNIT



U. S. Bureau of Reclamation photo

Extensible feeder tubes cantilevered from truck-mounted pumps and storage tanks expedite the application of fuel oil to control weed growths along canal banks. This rig is being used by the Salt River Valley Water Users' Association on the Grand Canal near Phoenix, Ariz.

ROLLER STRAIGHT EDGE

A new model of the "roller straight edge," a device for the determination of surface variations in new pavement surfaces, is tested by its developer T. W. Loftis, instrument maker for Virginia's State Highway Department.

Book Notes and Reviews

The month's addition to the engineer's reading and reference list

How to Make Surveys

SURVEYING INSTRUMENTS AND METHODS—By Philip Kissam. 384 pp. McGraw-Hill Book Co., New York 18 and London. $3.50.

Here is a book packed full of the sort of practical information about surveying instruments and their use that every young engineer needs when he begins to put his theoretical training to use in the field. The older well-known surveying texts contain ample information on the principles involved in running surveys or setting grade stakes, but they lack information on the many little practical steps that come only through long experience in the field. These Prof. Kissam has brought together in this book, largely in the form of well-prepared sketches. Also included is information on the use of surveying instruments for setting machinery, giving grades for water mains and other operations not generally covered in surveying texts.

Groundwater Development

GROUND WATER: ITS DEVELOPMENT, USE AND CONSERVATION.—By E. W. Bennison. 509 pp. Edward E. Johnson, Inc., St. Paul 4, Minn. $2.25.

Dedicated to well-drillers, but broad enough in scope to interest all who are concerned with the development, use or conservation of groundwater, Mr. Bennison's compilation of articles that originally appeared in the *Johnson National Driller's Journal* over a six-year period shapes up into a book that is rich in practical value.

As the author points out, no claims are made that this is a scientific treatise. Rather, it is intended to present basic principles of groundwater hydrology, well construction and the techniques most commonly used in developing and pumping groundwater. This emphasis on the practical aspects will be appreciated by waterworks men.

Among the chapters that should have special appeal are those dealing with prospecting for groundwater, drilling machines and well records, design, construction and use of well screens, development of wells and gravel treatment. The section on contract forms, specifications and responsibilities of contracting parties outlines important legal phases of well construction.

In brief, this is a lot of book for the money.

Creating Employment

PUBLIC INVESTMENT AND FULL EMPLOYMENT—348 pp. International Labour Office, 3450 Drummond St., Montreal 25, Que., Canada. $2.25.

The idea of using public works as an anti-cyclical device is of ancient origin, but it has grown in popular acceptance in recent years, probably as a result of the work of Alvin Hansen and Maynard Keynes. The International Labour Office has been committed to it from its inception in 1919 as an instrument of the old League of Nations.

The office has been diligent in gathering information concerning the past use of public investment (the concept has been broadened by the ILO to include somewhat more than public works in the traditional sense) in various countries, and their contemplated use of the device in the future.

Because we live in one world economically—if not yet politically and socially—poverty anywhere constitutes a danger to prosperity everywhere. Thus, "a public-investment program in Great Britain, by maintaining high levels of national income there, would do much to foster prosperity in the Canadian Middle West." So also the timing of international lending so as to offset cyclical unemployment in both borrowing and lending countries is envisioned, although this "clearly requires control (over such lending) by an international authority." As a corollary, international control of planning, especially of vast national projects, would seem to be inevitable.

Just as the TVA, by raising the standard of living in several southern states, provided a new market for electric refrigerators made in Rochester and automobiles made in Detroit, so a TVA on the Danube may some day have far-reaching effects upon the well-being of workers in Chicago, Ill., and Manchester, England.

Nearly every industrial country sought to use public-works construction to some extent to combat unemployment during the depression of the '30's. Many of these attempts, however, were half hearted and inconclusive. Even Sweden, which has officially pursued an anti-cyclical policy for some 40 years, seems to have relied more upon direct relief than public works when the test of the 1930's came.

The experience of the United States during the depression is heavily documented, from the first attempts of the Reconstruction Finance Corporation to stimulate public-works construction, through FERA, PWA, CWA and WPA. The RFC effort seems to have failed because of the insistence upon the self-liquidating character of the projects financed. The authors seem to betray a preference for force account projects of the CWA and WPA type because they put far larger numbers of people to work quickly than the Public Works Administration. But from my own personal experience I would question that "total employment per million dollars spent, both on and off the site, was greater on WPA than on PWA projects," or that "there is reason to suppose that both their CWA and WPA secondary and their primary effects were greater per dollar spent than those of PWA projects. . ."

Many of the WPA projects, especially the earlier ones, were hastily improvised and used few materials and little equipment. While many men could be assembled on the site and provided with crude hand tools, the extent to which they might be said to be usefully employed was frequently a question. PWA, on the other hand, drew for its materials and equipment upon the mines, forests, mills, factories and transportation facilities of the country. Even the secondary effects of PWA were never adequately appraised, and the tertiary effects were incalculable.

The real shortcoming of PWA grew

out of the fact that detailed construction plans had not been prepared in advance. If an adequate supply of completed plans had been available in 1933, CWA and WPA might not have been necessary.

However, this is a valuable book which should be read by every advocate of public investment as an anticyclical factor.—*Reviewed by* PHILIP B. FLEMING, *Administrator of the Federal Works Agency.*

British Conveyors and Cranes

CONVEYORS AND CRANES—By Wm. H. Atherton. 360 pp. Pitman Publishing Co., London and New York. $6.00.

Definitely a British book in which the technical content is concentrated on mechanical handling of package and bulk goods by the several types of conveyors, elevators and skip hoists. Some design data and illustrations are of value to designers of this fundamental equipment. The information on cranes is limited and contains nothing on American equipment or practices.

Railroad History

THE ROAD OF THE CENTURY—The Story of the New York Central—By Alvin F. Harlow. 447 pp. Creative Age Press, New York. $4.

This is a history of the railroad that grew from a 17-mile line between Albany and Schenectady over a hundred years ago to a 10,000-mile network reaching from the Atlantic seaboard to the Mississippi today. In an interesting narrative style the author tells the story of the scores of little railroads that eventually were joined to form the New York Central and Hudson River Railroad up the Hudson and across New York State to Buffalo. There is also the history of the many lines further west which in the end united to make the New York Central System as we know it today.

The great engineering feats that were performed on the water level route are mentioned only incidentally. More emphasis is laid on financial features and the triumphs of management. The great hero, of course, is the doughty old Commodore Cornelius Vanderbilt, although almost equal tribute is paid to his able son, William H. Vanderbilt. The stock market battles of the 1860's and 70's are recounted. The dramatic picture of the Michigan Central and the Michigan Southern fighting each other as they raced for Chicago is one of the high points of the book. Another is the account of the struggles of the Harlem Railroad, and of the building of the first Grand Central Station and the Park Avenue tunnel. Considerable attention is also paid to the West Shore Railroad's long and losing battle against inevitable failure.

The book is thoroughly illustrated with maps and pictures of early timetables and posters, famous locomotives and trains, railroad stations old and new, together with portraits of the many outstanding personalities who made this great railroad.

Miscellaneous Notes on Booklets and Reprints

INFORMATION ON THE LIFE of cast iron pipe is given in a pamphlet entitled "Survival and Retirement Experience with Cast Iron Water Mains", published by the Cast Iron Pipe Research Association, Chicago 3, Ill. Data in the pamphlet are taken from a book "Survival and Retirement Experience with Water Supply Facilities", to be published soon by the American Water Works Association.

A NEW PRICE LIST of standards of the American Standards Association has just been issued. Copies may be obtained from the association without charge at 70 E. 45th St., New York 17.

AMERICAN HIGHWAY ENGINEERS can get a fresh view of many of their operations from "Impressions of Roads and Road Research in North America", Road Research Technical Paper No. 7, of the British Department of Scientific and Industrial Research. Some of the comment such as the lack of uniformity in road marking in this country is quite pertinent. Copies can be obtained from His Majesty's Stationery Office, London, W. C. 2. Price 1s 6d.

A FIFTEENTH ANNIVERSARY BOOKLET has been issued by the Engineers' Council for Professional Development, 33 West 39th St., New York 18, N. Y. The pamphlet gives a brief history of the council, an outline of its major accomplishments, including a list of the engineering curricula accredited by ECPD, and an outline of ECPD's continuing program. Also included is a summary of recent reports on the future need for engineers.

A BIBLIOGRAPHY and a work sheet to aid in writing and revising building codes have been issued by the Construction Division, Department of Commerce, Washington 25, D. C. They are CD-1 "Publications Relating to the Preparation and Revision of Building Laws" and CD-2 "Work Sheet for Checking the Dates of Standards and Specifications Incorporated by Reference in Building Laws."

New Engineering Books

HIGHWAY MATERIALS—5th Edition—Part I Specifications, 274 pp. Part II Tests, 364 pp. American Association of State Highway Officials, 1220 National Press Building, Washington, D. C. $6. for the two parts.

THE MUNICIPAL YEAR BOOK—1947—Clarence E. Ridley and Orin F. Nolting, editors, 550 pp. The International City Managers' Association, 1313 East 60th St., Chicago, Ill. $8.50.

MATERIALS HANDBOOK—Sixth edition. By George S. Brady, 831 pp. McGraw-Hill Book Co., New York 18, and London. $7.

THE LIFE AND WORK OF WILLIAM CAWTHORNE UNWIN—By E. G. Walker. 239 pp. George Allen & Unwin, Ltd., Ruskin House, 40 Museum St., London, W. C. 1, England 12s. 6d.

LUMBER: MANUFACTURE, CONDITIONING, GRADING, DISTRIBUTION AND USE—By Nelson C. Brown. 344 pp. John Wiley & Sons, New York. Chapman & Hall, London. $4.25.

THE CHEROKEE PROJECT—Technical Report No. 7. Tennessee Valley Authority. 411 pp. Superintendent of Documents, Washington, D. C. $1.50.

THE GUARANTEE OF ANNUAL WAGES—By A. D. H. Kaplan. 269 pp. The Brookings Institution, Washington, D. C. $3.50.

CONVEYORS AND CRANES—By W. H. Atherton. 360 pp. Pitman Publishing Co., New York and London. $6.

THE MODERN GAS TURBINE INCLUDING JET PROPULSION—2nd Edition—By R. Tom Sawyer. 224 pp. Prentice-Hall, New York 11. $4.

(*Continued on page* 134)

Comment and Discussion

Readers' opinions on matters that concern engineers and contractors

Relief Wells at Dams

Sir: Considering the great volume of past engineering records it is not surprising to find occasional announcements of "new" methods, which were already recorded in this journal many years ago. In the Aug. 21 issue (vol. p. 246) Mr. Middlebrooks describes "a new and unique method of controlling underseepage, consisting of installation of relief wells, which has been pioneered by the Corps of Engineers".

This journal carried some thirty years ago full-page advertisements by the Ambursen Co. describing hollow corewalls with relief wells extending deep into the foundation. That advertisement drawing even found its way into modern handbooks (See Schoklitsch's "Hydraulic structures", p. 501).

In another recent handbook, Creager, Justin and Hinds' Engineering for Dams", p. 69, gives a section through the Svirstroy dam in Russia, showing two rows of relief wells. This dam was built in 1933. There are in this country at least ten dams which sustain up to 50 percent greater head than Svirstroy, also built on a clay foundation but which have neither upstream piling and blanket, drainage galleries, drainage wells or sand filters. The percolation distance is also much shorter. They are nevertheless wholly permanent and safe structures as they were built more than thirty years ago (See p. 1306, *Transactions* ASCE, Vol. 100, 1935).

On page 1332 of this same volume a description of application of deep relief wells at the Alcona Dam is given. This dam was placed in operation in 1923. Thirty drain wells, each from 100 to 150-ft. deep, have been drilled. Owing to the extreme fineness of the quicksand on which the dam is founded, constant maintenance is required. The wells become plugged in about four years time. They have been in operation for seventeen years.

The records further show that the conventional theoretical requirements for toe drainage, and the large sums spent for such drainage, are in many cases not sustained by long experience. Dams number 14, 15, 27, 152, 153, 157, 158 of the list on page 1306 mentioned above have permanent wet downstream slopes for thirty years or more, nevertheless are completely safe and permanent structures. Planting of willow cuttings, costing very little, stabilized the toe of No. 158. Owing to degradation of the tail race, this dam now has a head of 60 ft. It was completed in 1917.

A. Streiff,
Consulting Engineer,
Jackson, Mich.

Traditions Die Hard

Sir: Just a few remarks anent your editorial "Traditions Die Hard" in *ENR* Sept. 4, vol. p. 311.

During the writer's practice of engineering, mostly in the western states and some in foreign countries, he has never found it necessary to even consider entering competitive bidding, although frequently solicited to do so, during his more than 61 years in active practice. However, the entering into competitive bidding for engineering employment has greatly increased during recent years, and is now indulged in by many reputable engineers.

The reason for the departure from our old tradition and what is still considered good engineering ethics is to be found in the rapid increase of public ownership and control of engineering projects. This public ownership trend originated in public ownership of water works, but now has progressed so far to the left as to approximate Marxism. The socialist doctrine of Karl Marx is in flat contradiction of our free enterprise system, and will end up in communism, after passing the intermediate stage, known as socialism.

It will in time eliminate free engineering practitioners, unless checked, and result in slave technicians as in Russia.

Frederick C. Finkle,
Consulting Engineer,
Beverly Hills, Calif.

Fireproofing Costs in Bids

Sir: In your editorial, captioned "Housing Bids Raise Questions", (ENR Aug.21,vol.p.244) cost comparisons are made between a reinforced concrete apartment structure and a similar building having a structural steel frame fireproofed with concrete. The fact that the steel frame is cost-burdened with concrete fireproofing is at this time a handicap that can't be overcome in the cost race with a reinforced concrete frame.

Were the steel frame designed as a fire-protected (not concrete fireproofed) structure and a system of floor construction used wherein the dead load including partitions would be 60 psf., the price would come in considerably lower than that of a similar reinforced concrete frame. Economy in this instance is not a question of close estimating; it is merely a case of removing from the steel frame costly, unwarranted, fireproofing.

Harry Wolf
Consulting Engineer
Philadelphia 43, Pa.

"Sidewalk Sitdown"

Sir: The illustration on page 780 of your issue of May 8, 1947, showing the "Sidewalk Sitdown" by women at Boston calls to mind the action of the Maori women in Taranaki, New Zealand, 70 years ago, when their tribes disputed the rights of the government to survey a road through their land. To make it unnecessary for the men to get themselves into trouble the women sat on the surveyors pegs and brought work to a standstill. When armed police were sent to the scene they were met, not by warriors, but by women and children singing songs of welcome.

So there is nothing new in a "sitdown strike."

T. Malcolm Corkill
Invercargill, N. Z.

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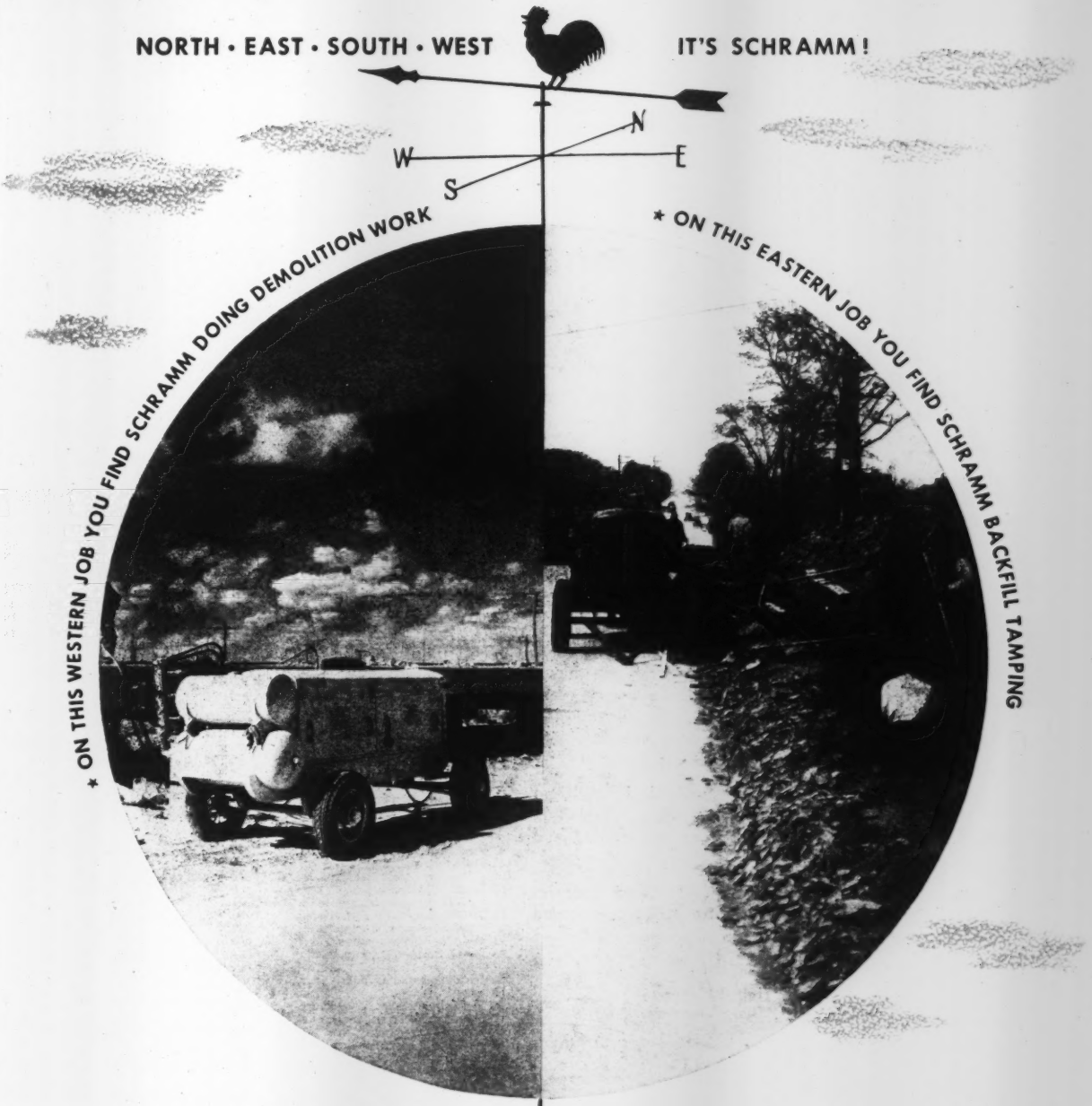

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UNIT PRICES BID BY CONTRACTORS

Delta-Mendota Intake Canal and Tracy Pumping Plant, Central Valley, Calif.

OWNER: Bureau of Reclamation, Antioch, California; O. G. Boden, Construction Engineer.

PROJECT: Construction of Delta-Mendota intake canal, Tracy pumping plant, and discharge lines, part of the Central Valley Project in Central Valley, California. The 2.5 mile Delta-Mendota intake canal will carry up to 4,600 cu. ft. of Sacramento River water a second from the Delta Cross-Channel to the Mendota pool. Released from the pool through existing irrigation systems, the water will irrigate the Lower San Joaquin Valley crop lands. This intake canal is one of a system of canals on the Central Valley Project, which will have a total length of more than 400 miles and will furnish water to 2,100,000 acres of land requiring a full or a supplemental supply for irrigation purposes. The canal also will supply water for municipal and industrial uses. The pumping plant near Tracy will force water uphill from the Delta-Mendota intake canal through 3-mile long, 15-foot pipes to a height of approximately 200 feet where it will empty into the beginning of the canal and send the water flowing for a distance of 120 miles through the Delta-Mendota Canal along the west side of the San Joaquin Valley. The pumping plant structure, a railroad and highway culvert, pipe anchors and the surge tank foundations will be built on piles driven to a depth of about 42 feet.

CONDITIONS: Access to job site is available by rail and highway. Stipulated contract time is 960 days. Prevailing skilled labor wage rate is $1.50 per hr.; semi-skilled and common, $1.40 per hr.

BIDS: Four bids were received, ranging from the contract low of $5,888,695.00 to $7,395,104.00. Contract was awarded June 27, 1947.

LIST OF BIDDERS:

1. Stolte, Inc., Oakland, Calif., United Concrete Pipe Corp., and Ralph A. Bell, Monrovia, Calif., and Duncanson Harrelson Co., Oakland, Calif. (contract) — $5,888,695.00
2. Guy F. Atkinson Co., So. San Francisco, Calif., W. E. Kier Constr. Co., San Diego, Calif., Bressi and Bevanda Constructors, Inc., Los Angeles, Calif., and A. Teichert & Son, Inc., Sacramento, Calif. — 6,139,222.50
3. George Pollock Co., Sacramento, Calif., Macco Corp., Clearwater, Calif., and M & K Corp., San Francisco, Calif. — 6,977,744.00
4. Morrison-Knudsen Co., Inc., Los Angeles, Calif., M. H. Hasler, Santa Ana, Calif., and Peter Kiewit Sons & Co., Omaha, Neb. — 7,395,104.00

Item	Quantity	Unit Prices (1)	(2)	(3)
Schedule No. 1				
1 Removing existing piling	lump sum	$3,040.00	$2,000.00	$1,000.00
2 Unwatering foundations for railroad and highway culvert	lump sum	20,000.00	60,000.00	75,000.00
3 Unwatering foundations for pump. plant site	lump sum	81,000.00	100,000.00	100,000.00
4 Excavation for canal	3,817,000 cy	0.25	0.315	0.36
5 Excavation for canal structures	72,300 cy	0.55	0.65	1.25
6 Excav. for pump.-plant struct.	450,000 cy	0.55	0.75	1.25
7 Excav. for pump discharge pipes	62,000 cy	0.55	0.75	0.66
8 Backfill	200,000 cy	0.30	0.40	0.26
9 Compact. backfill for struct.	68,000 cy	2.20	2.75	2.00
10 Compacting backfill for steel discharge lines	30,500 cy	3.00	4.00	2.00
11 Riprap	2,550 cy	10.00	10.00	14.50
12 Screened-gravel bed. for riprap	850 cy	7.00	5.50	
13 Screened-gravel blanket	730 cy	6.00	4.75	
14 Gravel surfacing	3,000 cy	5.00	4.00	
15 Furn. treated-timber piles, up to 45 ft. in length	23,000 lf	0.90	1.00	
16 Furn. untreated-timber piles, up to 45 ft. in length	87,100 lf	0.40	0.50	
17 Furn. untreated-timber piles, 50 ft. to 65 ft. in length	18,000 lf	0.46	0.55	
18 Furnishing steel H piles	86,500 lf	2.10	1.90	
19 Driving vertical treated-timber & untreated-timber piles	105,000 lf	1.20	0.55	
20 Driving batter untr.-timber piles	10,000 lf	1.20	0.65	
21 Driving vertical steel H piles	67,000 lf	1.10	0.85	
22 Driving batter steel H piles	12,000 lf	1.10	1.00	
23 Furnishing and handling cement	70,000 bbl	4.00	2.80	
24 Furn. reinf. bars, 1 in. dia. and larger	1,225,000 lb	0.06	0.045	
25 Furn.reinf. bars, ⅜ in. dia. to ¾ in. dia. incl.	677,000 lb	0.06	0.046	
26 Furn. reinf. bars, ½ in. dia. and smaller	82,000 lb	0.07	0.048	
27 Placing reinf. bars, 1 in. dia. and larger	3,615,000 lb	0.035	0.03	
28 Placing reinf. bars, ⅜ in. dia to ¾ in. dia., incl.	2,530,000 lb	0.035	0.035	
29 Placing reinf. bars, ½ in. dia. and smaller	485,000 lb	0.04	0.04	
30 Conc. in paving & cover slabs	900 cy	30.00	19.50	
31 Conc. in railroad & highway culvert & in inlet-transition struct.	4,000 cy	40.00	42.00	
32 First-stage concrete in pumping-plant substructure	17,000 cy	32.00	26.00	
33 First-stage concrete in pumping-plant superstructure	9,000 cy	50.00	50.00	
34 Second-stage concrete in pumping-plant structure	6,300 cy	25.00	14.00	
35 Concrete in blockouts	150 cy	60.00	60.00	
36 Concrete in discharge-pipe struct.	15,000 cy	20.00	22.00	
37 Painting reinforcement bars	25,000 lf	0.10	0.30	
38 Constructing control joints	5,700 lf	1.00	3.30	
39 Furnishing and placing corkboard joint filler	20,000 sf	0.40	0.60	
40 Furnishing and placing ½ in dehydrated-cork joint filler	550 sf	1.00	2.70	
41 Furnishing and placing 1 in. dehydrated-cork joint filler	270 sf	2.00	3.30	
42 Furn. and placing met. seals	6,000 lf	3.00	2.25	
43 Placing rubber water stops	80 lf	2.00	2.70	
44 Constructing asphalt seals	750 lf	0.30	8.00	
45 Insulating reinf. bars & electrical metal conduit, intersection	4,500 ea	0.30	0.35	
46 Finishing lighting recesses	35 ea	15.00	8.00	
47 Furn. and placing membrane waterproofing	22,000 sf	0.20	0.50	
48 Furn. and applying mastic w. p.	2,000 sy	1.70	3.00	
49 Furnishing and applying dampproofing	100 sy	1.20	2.70	
50 Painting interior surfaces of pump discharge pipes and surge tanks	480,000 sf	0.20	0.35	
51 Painting exposed ext. surf. of pump discharge pipes & surge tanks	325,000 sf	0.20	0.20	
52 Installing butterfly valves	450,000 lb	0.05	0.04	
53 Install. bulkhead gate guides and latches	68,000 lb	0.04	0.12	
54 Installing bulkhead gates	84,000 lb	0.04	0.07	
55 Installing cranes	505,000 lb	0.04	0.07	
56 Install. crane-runway, trashrake-gantry, and transfer-car track rails in concrete	97,000 lb	0.04	0.08	
57 Installing crane rail on timber ties	70 lf	15.00	7.00	
58 Installing trashracks	190,000 lb	0.04	0.08	
59 Installing miscellaneous equip.	35,500 lb	0.10	0.30	
60 Install. met. tubing, & brass, steel, w. i. & c. i. pipe, fittings, & valves, less than 6 in. nominal dia	50,000 lb	0.30	0.50	
61 Install. metal tubing, & brass, steel, w. i. & c. i. pipe, fittings, and valves, 6 in. & greater nominal dia	139,000 lb	0.25	0.16	
62 Installing metal inserts	1,000 lb	0.25	0.70	
63 Installing metal railings	48,000 lb	0.12	0.40	
64 Installing draft-tube pier noses	50,000 lb	0.05	0.15	
65 Installing embedded metal frames for openings in floors, walls, and decks	6,000 lb	0.15	0.40	
66 Installing oil storage tanks	7,000 lb	0.25	0.20	
67 Installing metal accordian doors	3,700 sf	0.60	2.00	
68 Installing metal swinging doors	1,200 sf	0.60	2.00	
69 Installing metal fire door	40 sf	1.00	2.70	
70 Furn. & install. met.-sash windows	1,600 sf	4.00	2.70	
71 Installing metal louvers	1,600 lb	0.20	1.00	
72 Installing metal toilet partitions	700 sf	0.60	1.00	
73 Install. misc. metalwork	10,000 lb	0.15	0.50	
74 Install. plumbing fixtures & appur. hardware	5,000 lb	0.25	0.40	
75 Furn. and install. embedded electrical metal conduit, 1¼ in. or less in diameter	16,000 lf	1.00	1.35	
76 Furn. and install. embedded met. cond., larger than 1¼ in. and not larger than 3 in. in dia	9,200 lf	2.00	2.00	
77 Furn. & install. embedded electrical nonmet. cond	200 lf	1.00	2.50	

Continued on page 117

Intake Canal, Pumping Plant, Calif.

Continued from page 114

78 Furn. and install. grounding material	6,500 lb	2.00	1.50	1.00
79 Furnishing and constructing guard-rails	3,300 lf	4.00	2.50	4.00
80 Transp. mat. of all kinds for the Gov. or its agents, other than the contr., bet. railhead and pumping-plant site	2,200 tons	10.00	8.00	6.60
Schedule No. 2				
81 Excavation for structures	142,000 cy	0.40	0.35	0.40
82 Backfill	81,000 cy	0.20	0.40	0.26
83 Compacting backfill for structures	1,800 cy	5.00	4.00	4.00
84 Trimming foundations for concr. in lateral lining	300 sy	1.50	4.00	1.30
85 Furnishing and handling cement	28,000 bbl	4.00	2.80	3.00
86 Furn. reinf. bars, 1 in. dia. and larger	896,000 lb	0.06	0.045	0.066
87 Furn. reinf. bars, ¾ in. dia. to 1 in. dia., inclusive	467,000 lb	0.06	0.046	0.066
88 Furn. reinf. bars, ½ in. dia. and smaller	20,000 lb	0.07	0.048	0.07
89 Placing reinf. bars, 1 in. dia. and larger	2,985,000 lb	0.03	0.03	0.053
90 Placing reinf. bars, ¾ in. dia. to ¾ in. dia. incl	1,556,000 lb	0.03	0.035	0.053
91 Placing reinf. bars, ½ in. dia. and smaller	66,000 lb	0.04	0.04	0.053
92 Concrete in paving slabs	100 cy	30.00	22.50	30.00
93 Concr. in discharge cond. and outlet struct.	18,300 cy	30.00	29.50	30.50
94 Concrete in lateral lining	25 cy	60.00	60.00	46.00
95 Furnishing and placing ½ in. dehydrated-cork joint filler	340 sf	2.00	2.50	1.30
96 Furn., plac. met. water stops	22,000 lb	0.25	0.50	1.30
97 Furnishing and placing roofing	475 sf	0.20	1.00	0.60
98 Installing siphon-breaker valves	7,000 lb	0.10	0.20	0.26
99 Installing metal swinging doors	20 sf	1.00	4.00	5.30
100 Install. misc. metalwork	500 lb	0.20	0.75	1.30
101 Furn. & install. embedded electric metal cond. 1¼ in. or less in dia	100 lf	1.00	1.50	1.00
102 Furn., install. embedded electr. met. cond. larger than 1¼" & not larger than 3" in dia	100 lf	5.00	2.50	3.00
103 Furn., install. grounding mat	50 lb	2.00	2.00	1.00

Watermain, Milwaukee, Wisconsin

OWNER: City of Milwaukee, Wisconsin; Joseph P. Schwada, City Engineer

PROJECT: Laying of watermains along N. 3 St., W. Vine St., to W. Wright St., in Milwaukee, Wisconsin. Work involves removal of existing service and water pipes and installation of service pipes, ranging from ¾ in. to 2 in. in size, and of cast-iron pipes, ranging from 3 in. to 48 in., including 1.666 ft. of the ¾ in. service pipe and 4.260 ft. of the 8 in. cast iron pipe.

CONDITIONS: City of Milwaukee will furnish water pipe, gate valves and hydrants. It will be necessary to break out a brick and concrete base pavement. Ground is of clay composite. All excavated materials are to be removed and trenches backfilled with sand and gravel. Access to job site is by highway only. Contract completion date is November 15, 1947. Skilled labor wage rates range from $1.85 to $2.15 per hr. Semi-skilled wage rate is $1.65, and common labor rate, $1.45 per hr.

BIDS: Four bids were received, ranging from the contract low of $91,738.65 to $98,547.43. Contract was awarded August 15, 1947.

LIST OF BIDDERS:

1. L & L Service Co., Milwaukee, Wis. (contract)	$91,738.65
2. R-W Const. Co., Milwaukee, Wis.	92,527.20
3. Tomaro, Carle & Tomasini, Cudahy, Wis.	96,847.80
4. Old Const. Co., Milwaukee, Wis.	98,547.43

		Unit Prices		
Item	Quantity	(1)	(2)	(3)
1 Service pipe—¾ in	1,666 f	$5.25	$5.25	$5.60
2 Service pipe—1 in	362 f	5.25	5.60	5.50
3 Service pipe—1½ in	62 f	5.75	6.50	6.00
4 Service pipe—2 in	24 f	6.25	8.50	7.50
5 Cast iron pipe—3 in	21 f	6.75	9.00	9.50
6 Cast iron pipe—4 in	28 f	7.00	9.25	9.50
7 Cast iron pipe—6 in	149 f	8.50	7.80	8.75
8 Cast iron pipe—8 in	4,260 f	8.25	7.80	8.00
9 Cast iron pipe—12 in	980 f	7.80	8.30	8.90
10 Cast iron pipe—16 in	850 f	8.50	8.80	9.80
11 Cast iron pipe—20 in	20 f	26.00	16.50	18.00
12 Cast iron pipe—36 in	9 f	27.00	44.00	36.00
13 Cast iron pipe—48 in	80 f	45.00	43.50	40.00
14 Hydrant pipe—6 in	344 f	8.50	7.25	8.75
15 Blow off pipe—6 in	25 f	8.50	7.75	7.00
16 Hydrant drain—3 in	344 f	2.50	2.00	3.00
17 Set gate valves—2 in	5 ea	4.00	12.00	7.00
18 Set gate valves—3 in	2 ea	5.00	12.50	9.00
19 Set gate valves—4 in	5 ea	5.00	15.00	10.00
20 Set gate valves—6 in	34 ea	10.00	18.00	12.00
21 Set gate valves—8 in	30 ea	12.00	22.00	15.00
22 Set gate valves—12 in	8 ea	15.00	25.00	20.00
23 Set gate valves—16 in	3 ea	22.00	28.00	30.00
24 Set gate valves—20 in	1 ea	35.00	35.00	50.00
25 Set hydrants	30 ea	20.00	33.00	35.00
26 Shut off small sew	5 ea	30.00	22.00	20.00
27 House sewer extensions	9 ea	22.00	40.00	50.00
28 Const. gate valve manhole	1 ea	2500.00	2500.00	3000.00
29 Const. air cock manhole	1 ea	2000.00	2500.00	3000.00
30 Install. bubbler assembly	1 ea	175.00	125.00	2000.00
31 Abandoning fire cisterns	4 ea	125.00	85.00	50.00
32 Remove service pipe—2 in	38 f	3.00	4.00	4.00
33 Remove service pipe—3 in	13 f	3.00	4.00	4.00
34 Remove water pipe—6 in	84 f	5.00	5.50	6.00
35 Remove water pipe—4 in	32 f	4.00	4.50	6.00
36 Remove water pipe—8 in	25 f	6.00	5.50	6.00
37 Remove water pipe—12 in	18 f	6.00	7.00	10.00
38 Remove water pipe—16 in	5 f	8.00	8.00	15.00
39 Remove water pipe—36 in	9 f	20.00	12.00	25.00
40 Remove hydrant pipe—6 in	73 f	5.00	8.00	6.00

Water Pipe Lines, Delaware, Ohio

OWNER: City of Delaware, Ohio; Burgess & Niple, Engineers.

PROJECT: Installation of 23,000 ft. of 2 to 12 in. cast iron water pipe and appurtenances and repaving sections of street in Delaware County, Ohio.

CONDITIONS: Materials are to be furnished by contractor. Contract time is 210 days after delivery of material. Access to job site is by both rail and highway. Skilled labor wage rates range from $1.25 to $2.00 per hr.; semi-skilled, from $1.00 to $1.50 per hr.; and common, from $.65 to $1.25 per hr.

BIDS: Eight bids were received, ranging from the contract low of $99,862.00 to $131,345.25. Contract was awarded July 15, 1947.

LIST OF BIDDERS:

1. Christopher Const. Co., Columbus, Ohio (contract)	$99,862.00
2. Thompson-Conie Co., Columbus, Ohio	108,229.00
3. L. Walker Fauber, Ashland, Ohio	115,334.10
4. Coleman & Trainor Co., Huntington, W. Va.	116,042.10
5. H. E. Miller, Columbus, Ohio	120,190.90
6. G. H. Leach Co., Bellefontaine, Ohio	127,097.00
7. B. Fatol, Cleveland, Ohio	128,321.00
8. Haddad Const. Co., Columbus, Ohio	131,345.25

		Unit Prices		
Item	Quantity	(1)	(2)	(3)
1 Cast iron pipe—12 in	8,050 lf	$4.70	$5.00	$5.14
2 Cast iron pipe—8 in	3,360 lf	3.00	3.20	3.59
3 Cast iron pipe—8 in	1,360 lf	3.00	3.20	3.42
4 Cast iron pipe—8 in	1,790 lf	3.00	3.20	3.48
5 Cast iron pipe—6 in	3,885 lf	2.25	2.55	2.77
6 Cast iron pipe—6 in	840 lf	2.25	2.55	2.72
7 Cast iron pipe—6 in	350 lf	2.25	2.55	2.85
8 Cast iron pipe—6 in	610 lf	2.25	2.55	2.77
9 Cast iron pipe—6 in	1,395 lf	2.25	2.55	2.73
10 Cast iron pipe—6 in	700 lf	2.25	2.55	3.12
11 Cast iron pipe—6 in	310 lf	3.00	2.55	3.52
12 Cast iron pipe—2 in	700 lf	1.65	1.75	1.69
13 Cast iron pipe fittings	26,000 lb	0.12	0.14	0.15
14 Corrugated steel pipe	223 lf	15.00	25.00	30.00
15 Valve, 12 in., box	10 ea	160.00	140.00	181.00
16 Valve, 8 in., box	12 ea	80.00	80.00	85.00
17 Valve, 6 in., box	55 ea	55.00	60.00	62.00
18 Valve, 2 in. & box	4 ea	30.00	45.00	35.25
19 Fire hydrant, 2-2½ in. N. S	15 ea	125.00	155.00	148.00
20 Fire hydrant, 2-2½ in. N	21 ea	90.00	130.00	118.00
21 Repaving traffic bound surface	400 ton	3.00	2.50	3.30
22 Repaving surface treated pavement	1,500 sy	3.00	1.50	2.00
23 Making connection under pressure	1 ea	400.00	150.00	175.00
24 Reloc. of sewer house connect. to new gr.	100 lf	2.50	1.50	1.00
25 Connection, 1 in., from exist. serv. line to new main	3 ea	18.00	15.00	25.00
26 Connection, ¾ in., from exist. serv. line to new main	3 ea	14.00	12.50	25.00
27 Copper service line—1 in	30 lf	2.00	1.00	2.55
28 Copper service line—¾ in	30 lf	1.80	0.90	2.50
29 Lowering 4 in. water line on Frank St	200 lf	1.60	2.50	1.50

10 TYPES OF OZALID PRINTS

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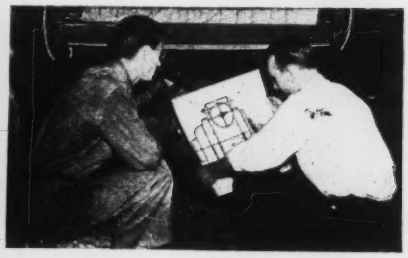

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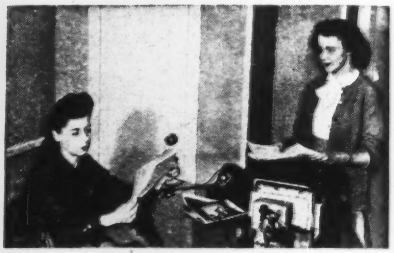
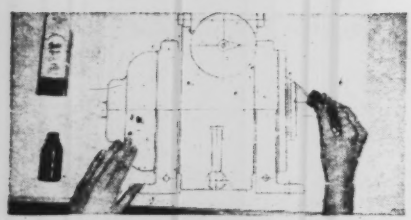


By assigning identifying colors, you can distinguish prints of different departments... recognize checked from unchecked prints, etc.



4. OZALID SEPIA-LINE

5. OZALID DOUBLE-COATED SEPIA

6. OZALID TRANSLUCENT CLOTH

For "intermediates" which may be substituted for originals in subsequent print production. Important savings in time and labor are realized when design changes are necessary: Obsolete lines are removed with Ozalid Corrector Fluid; changes drawn in and required number of prints made from "new" masters.

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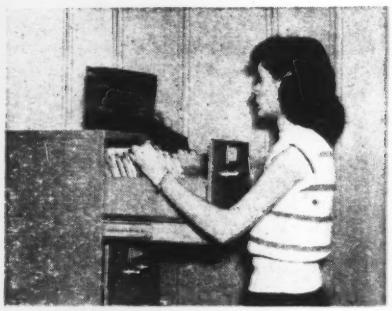

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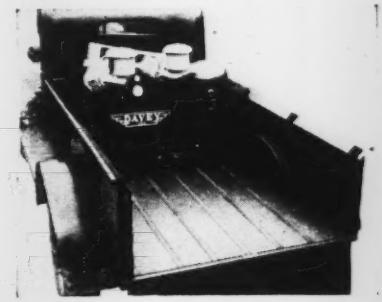
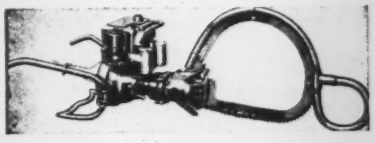
LINE MARKER — The new model Newaygo line marker is designed to provide a speedy, efficient and economical means for marking street crossings. The unit is light and easy to handle; it is simple and foolproof. The painting liquid is held at a fixed level in the reservoir in front of the paint tank by vacuum. From here the paint is picked up by an idler wheel, which dips into it and spreads the paint onto the marking wheel, which in turn rolls the paint evenly on the street surface. Any kind of paint may be applied.—*Newaygo Engineering Co., Muskegon St., Newaygo, Mich.*

BOILER FUSE—A new liquid, a colloid which seals leaks in high and low pressure boilers, radiators, piping, valves, heaters, etc., when poured into the heating system or boiler, immediately fills in the leaks with a lasting, pressure-resistant seal. Plumber's boiler fuse contains no solids which would interfere with the circulation of the heating system.—*The Penetone Co., Tenafly, N. J.*



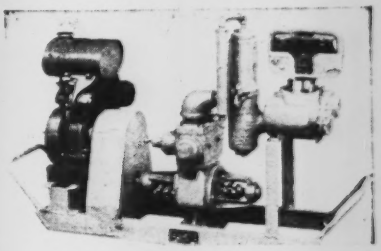
POWER TAKEOFF—Easily installed in driveshaft of Dodge Power Wagon truck, new heavy-duty power takeoff immediately converts unit into efficient equipment truck. Air compressors, generators, concrete mixers, welders, pumps, rock crushers and other truck-mounted equipment are driven direct from Dodge engine through takeoff. Need for separate, auxiliary engines is eliminated. Takeoff uses, as basic principle, internal and external gear drive, which operates as strong and durable spline. — *Davey Compressor Co., Kent, Ohio.*

WALL PLUGS—Made of corrosion-resisting, heavy-gage galvanized steel, wall plugs hold furring, door frames, window frames and cleats for fixtures. They are closed at side with clincher seam. Mortar cannot seep in at sides. They can be used with brick, hollow tile, concrete or cement block. They are 2¼x3 in., packed 250 in carton, with shipping weight of 100 lb. per 1,000.—*Bostwick Steel Lath Co., Niles, Ohio.*



POWER SAWS—Model 7 gasoline engine chain saw for felling and bucking big timber up to 12 ft. in diameter weighs only 75 lb. in 24-in. model. Available in 18-in. to 12-ft. capacities. Models 30 and 36 circular saws with 30-in. blade will cut 22-in.-dia. tree. Entire unit weighs only 200 lb. Bow chain saw (illustrated) is available in 18-in. capacity. Cutting unit can be swiveled to any angle for felling or bucking cuts.—*Mall Tool Co., 7757 S. Chicago Ave., Chicago 19, Ill.*

PORTABLE LIGHTING OUTFIT—Portable 3,000-w. light tower and generator rig is mounted on half-ton all steel Bantam utility trailers. Welded steel tower operates on hinge fastened to trailer canopy. On top of tower are two 1,500-w. clear globes in reflectors. When erected, tower is 18 ft. high. When folded, it has approximately 9-ft. road clearance. Lights are pivot mounted and have adjustable beam and spread. Welded to steel bed of trailer is Onan gasoline-powered generator with 5-gal. fuel tank and 12-v. circuit for battery charging. Gross weight that must be carried by trailer is 800 lb.—*Arrow Supply Co., Pittsburgh, Pa.*



PUMPING UNIT—Portable fuel transfer pumping unit, capacity 100 gpm., includes lightweight engine, rotary pump, air eliminator and metering device mounted on rack. Pump is driven by 6-hp. Salsbury single-cylinder, air-cooled 4-cycle gasoline engine. It is designed for fueling and defueling trucks, tractors, and other construction equipment.—*Harman Equipment Co., Los Angeles, Calif.*

CONVEYOR SYSTEM — Portable power conveyor can be set up or disassembled quickly to handle loads up to 100 lb. per ft. Built around basic power unit made up of standard 10-ft. straight section powered by ½-hp. slow-speed motor, system includes such accessories as 90-deg. power turns, automatic power conveyor intersection,

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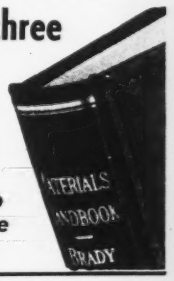

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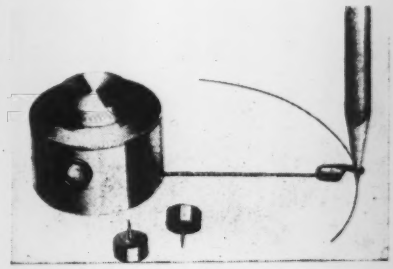
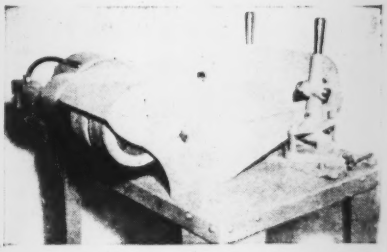
piling conveyor base, power feed attachment and gravity take-off attachment.—*Food Machinery Corp., Material Handling Division, Riverside, Calif.*



COMPASS—Circles from 2 in. to 12 ft. in diameter can be made with the new vest-pocket size Flex-A-Beam compass. It may also be used to draw ellipses, spirals, and arches. The compass consists of a stretch-proof linen line on an aluminum encased reel. Three special push-pins are furnished which serve as center points for the compass.—*Stewart-Jackson Instrument Co., Inc.*, 815 *Yale Ave., Los Angeles 12, Calif.*



BENCH GRINDER—New model DBS double belt bench grinder has heavy-duty drive shaft that mounts two sturdy 7-in. dia. by 2½-in. wide resilient contact rolls located side by side and only inches apart. Each contact roll is aligned with idler adjustable for abrasive belt tension, tracking and lining up with contact roll, which provides for use of two endless metal cutting abrasive belts 2½ in. wide by 60-in. circumference. Result is two-station grinder.—*Porter-Cable Machine Co., Syracuse, N. Y.*

STEEL BUILDINGS—Quonsets are now available in 36-ft. widths to meet demands from rural areas. Building may rest on foundation at grade or may be placed on masonry wall. Stran-Steel floor joists with bridging can be provided to enable application of concrete or wood planking floor. End walls, steel windows and doors can be provided. Production of Quonsets in 20, 24 and 40-ft. width, and wider multi-

DANIELSON

TWO-WAY AUTOMATIC SAFETY CHECK

eliminates hazard

of whipping air-lines

SAVES

TIME and LABOR—PNEUMATIC TOOLS—REDUCES COMPRESSOR EXPENSE — **detects, eliminates air-leaking equipment**

THE CHAMBER OF THIS VALVE IS CAST IN ONE PIECE

HIGH PRESSURE TESTED

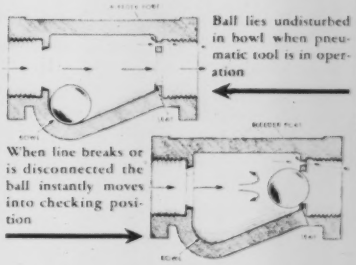
Needs no servicing or adjusting

NO SPRINGS—NO WEAR—NO GASKETS

- One moving part
- Automatic both directions
- Operates dependably under all pressures

This valve permits sufficient volume of air to operate all types of pneumatic tools commonly used in shipyards, mines, oil refineries, factories

Cross sections below show the valve in operating and in checking position


Ball lies undisturbed in bowl when pneumatic tool is in operation
When line breaks or is disconnected the ball instantly moves into checking position

The bleeder port, as shown in drawings, creates the reverse automatic action

The DANIELSON Safety Check Valve is used and recommended by many of the larger industries on the Pacific Coast.

Reduce Your Compressor Expense

Investigate!

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BREAK CONCRETE AND TAMP BACK FILL
THE
LOW COST WAY!
REPAVE IMMEDIATELY

Junior Model T

LOWER YOUR TRENCH WORK COSTS MANY TIMES BY USING RAPID PAVEMENT BREAKER MACHINES.

Write for details, information on other models and prices.

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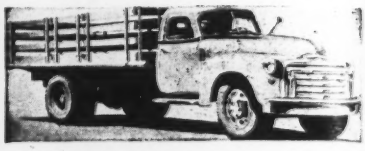
YEARS of unfailing operation have established the reputation of Earle operating machinery on movable bridges. For this reason Earle equipment is so often selected to operate railroad and highway bridges of all sizes. Earle experience and "over-sized" construction assure a minimum of wear and years of trouble-free, economical operation with little or no maintenance. Earle engineers will help you meet your gear or machinery problem, routine or unusual—get in touch with us, now. Or, if you want further information first, write for our NEW catalog containing Earle operating machinery. THE EARLE GEAR & MACHINE COMPANY, 4717 Stenton Avenue, Philadelphia 44, Pa. Sales Offices: 149 Broadway, New York 6; 901 Davis Avenue, Pittsburgh 12, Pa.

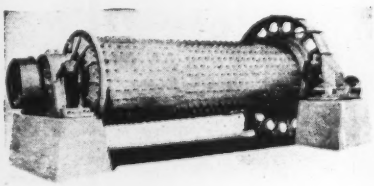
INCORPORATED IN EARLE OPERATING MACHINERY **EARLE GEARS**

arches, will continue.—*Great Lakes Steel Corp., Penobscot Bldg., Detroit, Mich.*



TRUCKS — Radical appearance changes plus revolutionary cab construction in light and medium-duty models (illustrated) and increased horsepower for heavy-duty gasoline and diesel group highlight improvements in 1947 GMC truck line. Two new models have been added to light and medium-duty lines—1½-ton FC 280 and 3½-ton FC 470. The 280 is designed for straight truck work in 11,000-lb. gross vehicle weight classification and 470 series provides models whose carrying capacities are equal to those of prewar heavy-duty 550 series. There are also five special tractor models with 72-in. CA dimension standard. Two of these are in light-duty series, while others are in medium-duty range.—*Truck & Coach Division, General Motors Corp., Detroit, Mich.*

STEAM HOSE—Improved "burst-proof" steam hose is said to have tube and cover that do not harden after prolonged exposure to steam at high pressures.—*B. F. Goodrich Co., Akron, Ohio.*



GRINDING MACHINERY—Primary jaw crushers are available in larger sizes from 30x42 in. up to 72x96 in.; primary gyratory crushers in sizes from 30 to 72 in.; and grinding mills (illustrated) from 6 ft. to 10 ft. 8 in. in diameter and up to 50 ft. in length. Rotary dryers, calciners, kilns and coolers have also been added to product range of company's Process Machinery Division.—*Nordberg Mfg. Co., Milwaukee 7, Wis.*

POWER SHOVEL—New ¾-cu. yd. machine, 33-M, with various front-end

AUSTIN-WESTERN 99-H POWER GRADER

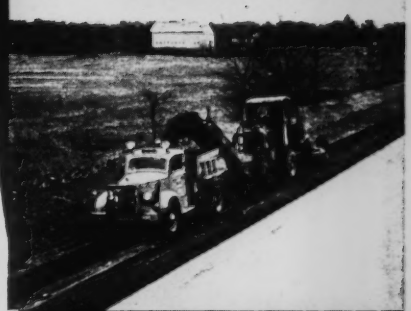
DITCH CLEANING. Rear steer places the rear truck up on the road where there is good footing.

ROAD WIDENING. The High-Lift Blade handles any degree of slope from flat to vertical.

HEAVY GRADING. Controlled Traction moves the windrow up the slope, farther and faster.

BLACK-TOP RESURFACING. All wheels miss the windrow.

Best for what ails your roads



LOADER ATTACHMENT. Removing excess material from ditch and shoulder.

SURFACE TREATMENT. The Roller Attachment has many uses, on many materials.

Primary and secondary roads took a terrific beating, from which they have not yet recovered, during the war years. Hundreds of thousands of miles are in desperate need of maintenance; other thousands of miles are equally in need of widening and resurfacing.

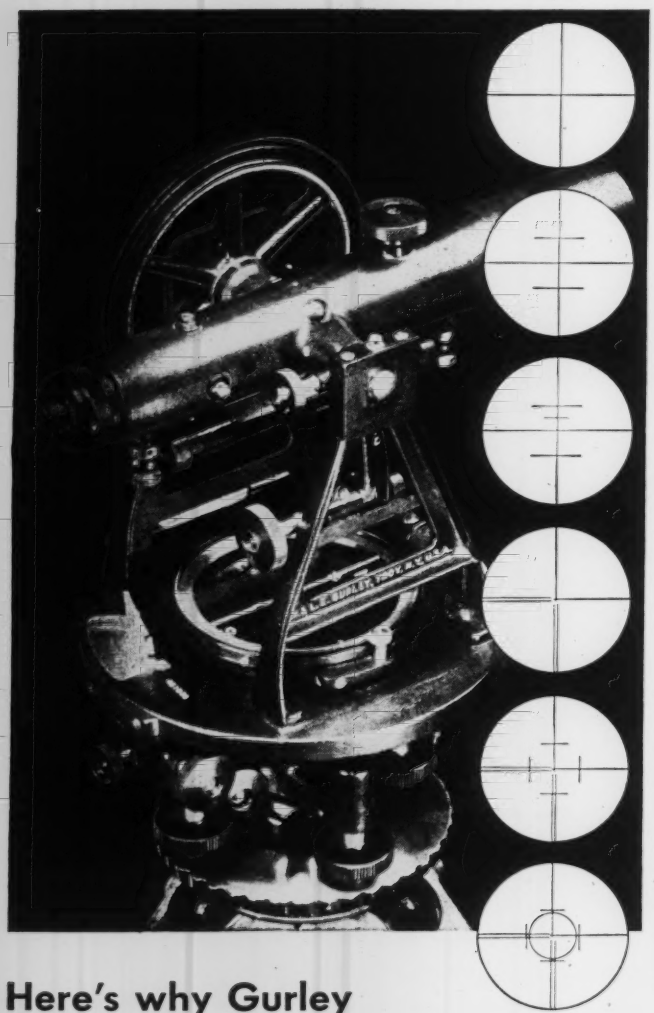
No single machine can perform *so many* of these jobs *so well* as the "99-H" Power Grader, with its exclusive All-Wheel Drive, All-Wheel Steer, Controlled Traction and Precision Sideshift; and its Bulldozer, Loader and Roller Attachments. Your nearby Austin-Western distributor will be glad to tell you the whole story.

AUSTIN-WESTERN COMPANY, AURORA, ILLINOIS, U.S.A.

BUILDERS OF ROAD MACHINERY

Austin Western

SINCE 1859



Only Gurley Offers These Improved Reticles

A. Plain cross-lines. For Levels.

B. Cross-lines and stadia lines, spaced 1:100.

E. & F. Quarter-interval stadia lines in upper or lower field, added to "B" for stadia readings of 1:400. For Alidades.

O. Parallel horizontal and vertical lines combined with regular cross-lines.

T. Stadia lines spaced 1:100 horizontally and vertically, added to "O".

S. Solar reticle. A combination of "O" and "T" with a circle 15′ 45″ radius for centering the sun's image.

Here's why Gurley Instruments now feature quick-reading glass reticles...exclusively

Study these new reticle patterns. Think of them in the telescope of your new Gurley transit. They'll make your next surveying assignment much easier.

Here's the latest advance in engineering instrument design—*glass reticles* to suit all surveying requirements and climatic conditions, developed by Gurley for added efficiency and accuracy.

Short stadia lines, spaced and ruled at precise intervals, are quickly identified since they do not extend over the entire field of view, as in continuous filament reticles. There is no chance of confusion with the regular cross-lines, nor can they be affected by moisture.

Several reticle pattern designs are available in Gurley instruments, from parallel horizontal and vertical lines, combined with cross-lines for triangulation and stellar observations, to solar reticles for centering the sun's image. Besides those illustrated Gurley can provide other patterns and vary the weight of reticle lines to suit your requirements. Gurley's knowledge of optics, lens grinding and specially developed reticle-making equipment assure all-important uniformity of line

Investigate this sighting method in new Gurley instruments, exclusive with Gurley. Write today for our bulletin No. 50 with its detailed description of the complete line of Gurley products. W. & L. E. GURLEY, UNION PLAZA, TROY, NEW YORK.

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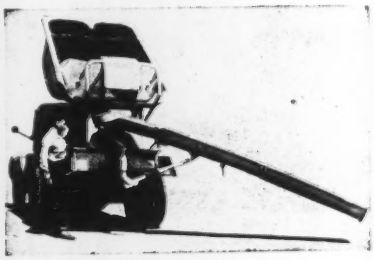
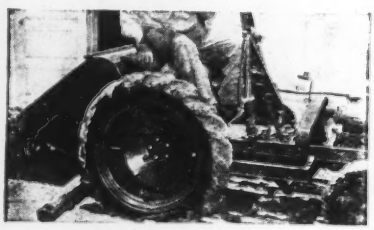
combinations is shovel, dragline, clamshell, crane and backhoe. Features include Marion air control, greatly simplified machinery deck with only two shafts across it, simple changeover for front-end equipment, use of 22 ball and roller bearings. Only 12 gears are used in entire machine. Conversion of front end does not require any changes of drum lagging, sprockets, or levers. Same drums are used on all combinations. Shovel boom also serves as boom for backhoe.—*Marion Power Shovel Co., Marion, Ohio.*



CONCRETE TRUCK — Model 2C Dumpcrete has increased discharge height, swing-away chute and steel plate running boards. Chute assembly can be quickly and easily swung away to either side in order to dump sand, gravel or concrete without using chute. Also in production is new Dumpcrete with 3-cu. yd. rated concrete capacity and 5-cu. yd. water level capacity, with same features as 2-yd. size. Four-yard body is also being produced.—*Maxon Construction Co., Inc., 131 N. Ludlow St., Dayton 2, Ohio.*

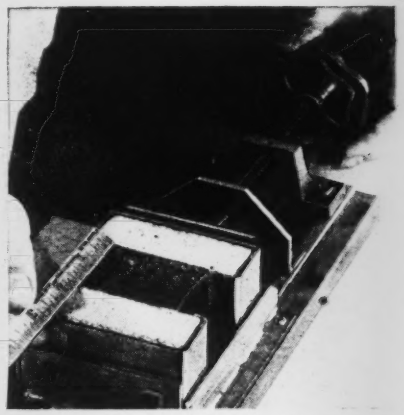


CONCRETE CARRIER—Specially designed bucket attached to rear of Gibson tractor is dumped by means of foot lever. Box in front counterbalances load at rear, enabling tractor to operate with its usual maneuverability. Carrier is built to hold 1 cu. yd. of mixed concrete.—*Nixon Mfg. Co., New Braunfels, Tex.*

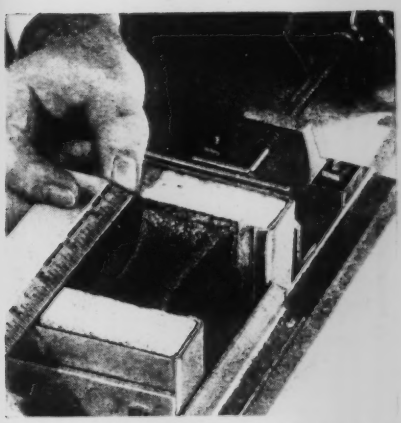
BULK CEMENT SPREADER—New machine spreads bulk cement for soil-cement stabilized pavement. Features include electrically welded frame, inclosed reversing transmission, pre-stretched endless belt, and self-aligning

We S-T-R-E-T-C-H-E-D a point...

Flintseal is poured between cement mortar blocks for testing.



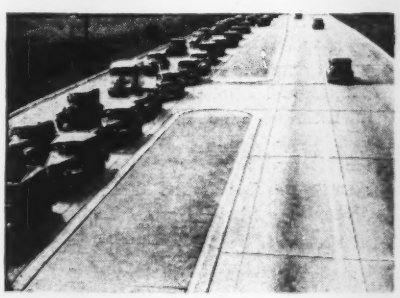
Blocks are extended 1/8 inch per hour.



Extended double to 3 inches, Flintseal maintains perfect bond.

...to PROVE one!

● They keep getting bigger! The Consolidated-Vultee B-36 can carry an atom bomb anywhere in the world and return. Sky giants like this must have concrete runways. Flintseal Joint-Sealing Compound increases service life and reduces maintenance cost for concrete paving.



● With more traffic than ever before on our highways, maintenance becomes even more important. Flintseal helps cut maintenance to the bone, because its bond remains firm and tight through repeated cycles of expansion and contraction.

It happened like this.

We were demonstrating the extensibility of Flintseal* Joint-sealing Compound as required by Federal Specification SS-F-336a . . . (5 cycles of extension from 1 to 1½ inches at 0° F. and recompression at room temperature).

Then, showing what Flintseal would really do, we extended to 3 inches. Three times its original width instead of half again as wide.

And the bond of Flintseal to the test blocks remained as firm as ever!

We admit that's stretching a point. Joint-sealing Compound probably would never be called on to perform like that. But isn't it a comfort to know that materials you use have that *additional* factor of adhesion and safety?

You get that and more with Flintseal. It's a *rubber-bearing, thermoplastic* joint-sealing compound especially developed by Flintkote to give you four important advantages:

1. Seals joints effectively against infiltration of moisture and other foreign matter through repeated cycles of expansion and contraction of concrete slabs.

2. Adheres firmly to concrete . . . without use of primers. Remains extensible and compressible.

3. Maintains resilience . . . does not become brittle and crack in coldest weather, nor will it flow in hottest weather.

4. Can be melted and applied quickly and easily in equipment especially designed to permit safe, economical handling.

For full details and application data on Flintseal, write today.

*Trademark

THE FLINTKOTE COMPANY, 30 Rockefeller Plaza, New York 20, New York

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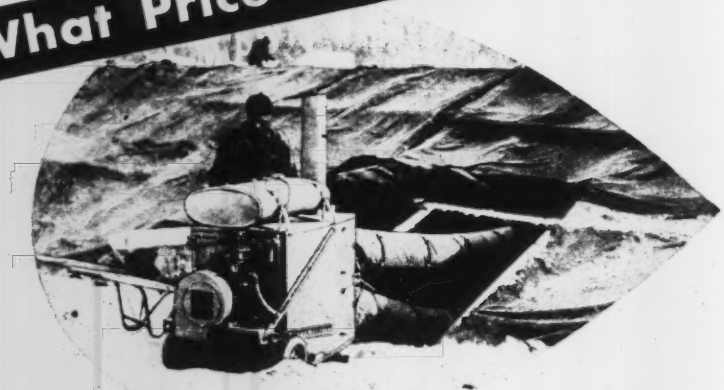
FLINTKOTE INDUSTRIAL PRODUCTS

HOT-POURED JOINT-SEALING COMPOUND

What Price Freezing?



PROTECT AGAINST TIME LOSS BY:

SPACE HEATING of temporary buildings, storage sheds, repair shops, buildings under construction.

PREHEATING engines and all kinds of mechanical equipment.

SPOT HEATING of materials, workmen, machinery, storage tanks, tools.

THAWING frozen areas and machinery, wheels, gears, transmissions, caterpillars, etc.

DRYING and curing of materials, plaster, paint, mortar, concrete, etc.

VENTILATING and heating of manholes, tunnels, box cars, ship holds, confined areas of all kinds.

KEEP GOING THIS WINTER WITH HERMAN NELSON PORTABLE HEATERS!

Let it Snow! Let it Freeze! Here's quick, clean, safe HEAT . . . to combat damp and icy weather on any job. Herman Nelson Portable Heaters protect men, machinery and materials. It's protection you can't afford to overlook — protection against time loss! Why gamble needlessly when, with Herman Nelson Portable Heaters at work, you can get HEAT, lots of it—where you want it, when you want it — without waste. This efficient unit is no bigger than a kitchen stove, yet produces enough heat for three ordinary 5-room houses. And it's all done without smoke, soot or open flame!

Write for Interesting, Free Booklet on "Cost Control"

THE HERMAN NELSON CORPORATION MOLINE ILLINOIS

SINCE 1906 MANUFACTURERS OF QUALITY HEATING AND VENTILATING PRODUCTS

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37 YEARS INSTALLING PILES OF EVERY TYPE

CAST-IN-PLACE CONCRETE COMPOSITE
STEEL SECTIONAL PIPE TIMBER

SOIL AND ROCK BORINGS

MacARTHUR CONCRETE PILE CORPORATION

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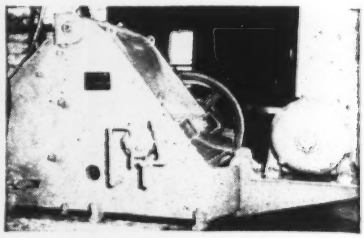
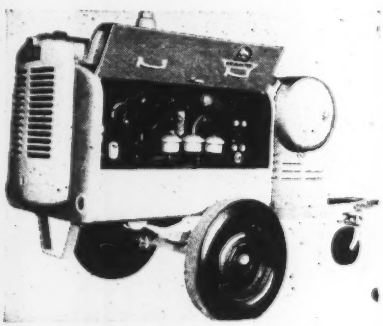
BOSTON • CINCINNATI • NEW ORLEANS

bearings. Only two men are needed to operate machine. On several jobs company claims, it has spread cement with substantially greater accuracy than required by specifications.—*T. L. Smith Co., 2835 N. 23nd St., Milwaukee 10, Wis.*



CRUSHER—Kue-Ken 30x15 Simplex crusher and special motor mounting bracket with vee flat drive is compact unit which crushes without rubbing. Sealed oil bath lubrication system protects mechanism and permits lubrication only twice a year. All-steel unit is equipped with dustite motor with cooling air ducts that can be piped to draw clean air from outside building. It is made in sizes 12x7 in. to 42x25 in.—*Straub Mfg. Co., Inc., 507 Chestnut St., Oakland, Calif.*



AIR COMPRESSOR—Newest Le Roi compressor is 85 Airmaster with Model D201 valve-in-head engine with replaceable cylinder sleeves, precision bearings, pressure lubrication and magneto ignition. It is regulated by Econotrol, which controls operation automatically. This model is offered in choice of two mountings. Type E pneumatic wheels and Type A hard wood skids. Full length tool boxes are standard equipment.—*Le Roi Co., 1706 S. 68th St., Milwaukee 14, Wis.*

JOINT-SEALING COMPOUND—Paraplastic, hot poured rubber seal for sealing expansion joints in all types of concrete construction, is now produced in colors, including green, red, gray, cream and yellow—*Servicised Products Corp., 6051 W. 65th St., Chicago 38, Ill.*

Steer Without Stopping

with OSGOOD Air Control

Smooth, effortless steering—without stopping the forward motion of the machine—with the cab in any position—that's OSGOOD Air-Controlled Steering! Independent air cylinders, actuated by a small lever in the cab, disengage and set steering brakes on the driving sprockets instantly, eliminating the need to hunt for a point where a steering lock can be engaged.

OSGOOD Air Control means faster, safer operation . . . more work done in less time, with less effort. Plan now to choose an OSGOOD. A complete line of power shovels, draglines, cranes, clamshells, backhoes and pile drivers . . . a model for every type of work.

POWER SHOVELS • CRANES • DRAGLINES • CLAMSHELLS • BACKHOES • PILE DRIVERS

THE OSGOOD CO. O-G THE GENERAL CO. EXCAVATOR

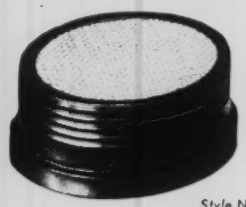
MARION OHIO

DIESEL, GASOLINE OR ELECTRIC POWERED • ⅜ TO 2½ CU. YD. - CRAWLERS & MOBILCRANES

for New protection against Old hazards ...get WILLSON

Style No. X41

GLOVE-FIT PROTECTION AGAINST SPLASH ... This Over-All* rubber goggle with snug fitting resilient rolled edge takes the danger out of splash and spatter; provides wearing comfort over spectacles.



Style No. 731

ONE-PIECE CAP CARTRIDGE ... New chemical cartridge respirator with four interchangeable cap cartridge filters protects against low concentrations of specific vapors and gases. U. S. Bureau of Mines Approved.

Style No. 750D

SETTLE THE DUST PROBLEM ... Newly approved by Bureau of Mines for all dusts. Easier breathing over long periods provided by extra large dual throw-away filters. *Reg. U. S. Pat. Off.

For complete information on these products and their application, as well as many more eye and respiratory protective devices, get in touch with your nearest Willson distributor or write us direct.

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Men and Jobs

Richard L. Woodward, who has spent the past few months in Washington, D. C., with the sanitary engineering division of the U. S. Public Health Service, has returned to PHS' steam sanitation section in Cincinnati, Ohio. His work in Cincinnati has been largely on cooperative studies with the U. S. Engineers in various parts of the country, advising on water pollution problems and on the effects of proposed reservoirs and canals. This fall Mr. Woodward will attend Harvard University, as he has been given one of the fellowships made available by the National Foundation for Infantile Paralysis.

Edward McK. Nason, city engineer of St. Catherine, Ont., has been appointed city engineer-director of works of St. John, N. B. A graduate of the engineering school of the University of New Brunswick in 1939, he had been with the New Brunswick highways department, and Commonwealth Air Training Plan, as a construction engineer, at Moncton, N. B. Lachine, Que. Boundary Bay, B. C., and Port Hardy, B. C. until going to St. Catherine. He will direct some large projects planned for St. John.

Col. James R. Townsend, who received his civil engineering degree at North Carolina State College, has been named city manager at Greensboro, N. C., succeeding Gen. James L. Frink, who resigned recently to head the construction and engineering department of Burlington Mills at Greensboro. In the Army for many years, Colonel Townsend is a veteran of both World Wars and once served as city engineer at Greensboro. He was retired from the Army in January of this year.

Herman Nelson, assistant Alabama State highway director, at his own request has been reassigned as assistant division engineer of construction in the first division. Mr. Nelson joined the State Highway Department in 1922 as an engineering aid but resigned in 1930 to take a position with the division of geology at the University of Tennessee. Two years later he returned to the highway department. He resigned again in 1943 to becom Madison County engineer, returning in January, 1947, to accept the assistant directorship.

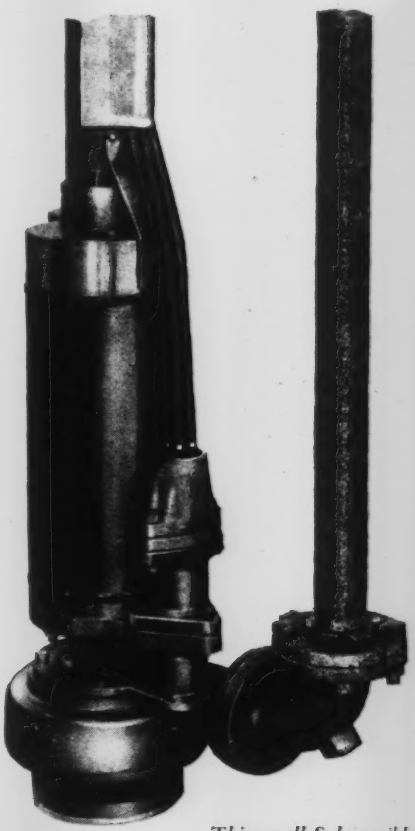
Maj. Joseph S. Grygiel has been

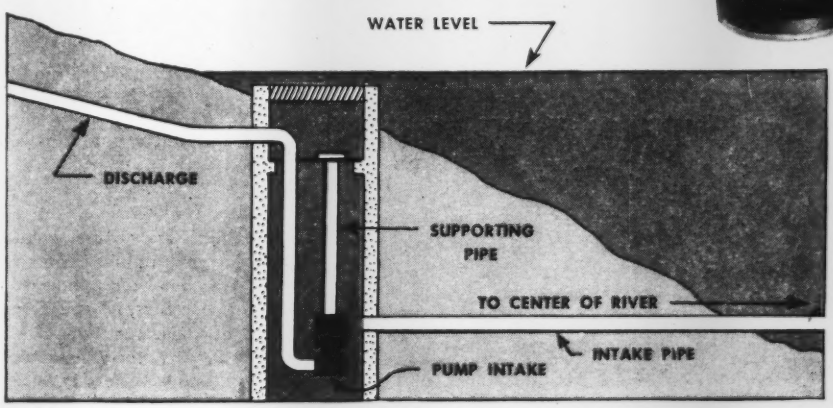
Pumping from lake or river?
. . . with icing in winter?
and high water in the spring?

get *Under* the trouble with a

BJ

SUBMERSIBLE RIVER INTAKE PUMP





This small Submersible River Intake Pump delivers river water at 100 gpm against a 55 ft. head. Consistent water delivery in spite of 40° below zero North Dakota Winter temperatures and Spring high water 45 feet above the pump intake.

CAPACITIES: to 5000 gpm
MOTOR SIZES: 7½ to 350 hp
INSTALLATION: Vertical, Horizontal, or on an incline

Down at the bottom of the river or lake it doesn't matter about ice or high water. That's why the Submersible is the logical solution to this kind of pumping problem. It operates regardless of surface conditions.

Sealed oil-filled submerged motor is close-coupled direct to pump (pump can be any one of several different types).

Starting panel (equipped for manual or automatic starting) can be located at any convenient point above flood stage. Discharge pipe should be buried enough to eliminate freezing.

Many other advantages. Easy to install. Simplified intake structure. No adjustments. No pump house. Operates for months without attention. Safe against vandalism.

Byron Jackson Co.
Established 1872
LOS ANGELES 54, CALIFORNIA
Offices in Principal Cities

CEMENT GUN COMPANY
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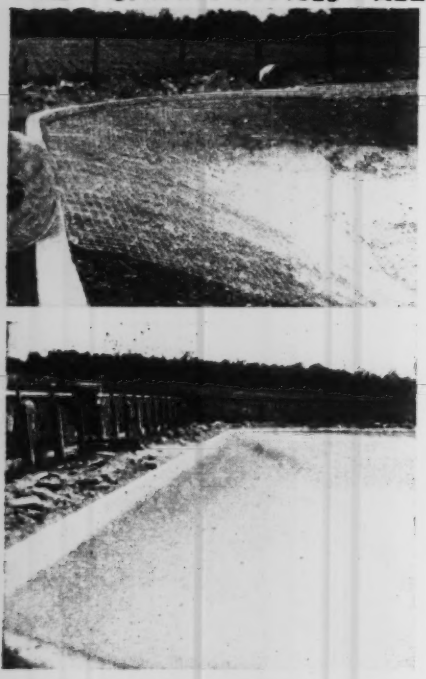

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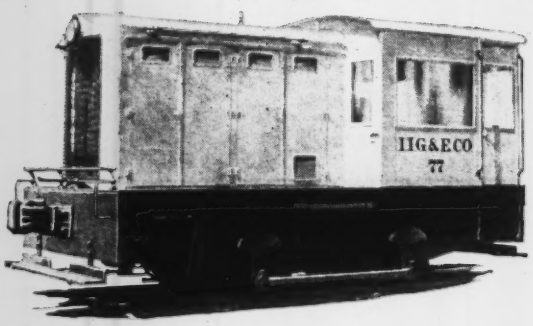

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appointed assistant district engineer at Seattle, Wash., assigned to duty in the engineering division. A 1941 graduate of the U. S. Military Academy, he served 2½ years in Alaska and the Aleutians and more recently was stationed at Fort Lewis.

Calvin Warnick, graduate of Utah State Agricultural College, has been appointed assistant professor of civil engineering at the University of Idaho.

Two new changes have been made at the Portland, Ore., District, Corps of Engineers, with **Col. Frank L. Beedle,** executive officer, transferred to Duluth, Minn., as district engineer and **Allen Lynn Darr,** head of the river and harbor projects action, retiring after 38 years of government service. Darr's service includes work with the Bureau of Reclamation, the Indian Service and the Bureau of Insular Affairs in Puerto Rico, as well as the U. S. Engineers. He joined the Portland district in 1929 and became its first safety engineer in 1933.

R. E. Norton, resident engineer of the State Highway Department at Heflin, Ala., for the last four years, has been promoted to the state headquarters as senior engineer.

W. D. Shannon, consulting engineer, Seattle, has been retained by the city of Ketchikan, Alaska, as a consultant for a hydroelectric power development near that city.

William W. Behrens, retired Navy Rear Admiral and former commandant of the Navy Training Center at Bainbridge, Md., has been appointed deputy secretary of Property and Supplies in charge of construction, Chester M. Woolworth, Property and Supplies Secretary, said yesterday.

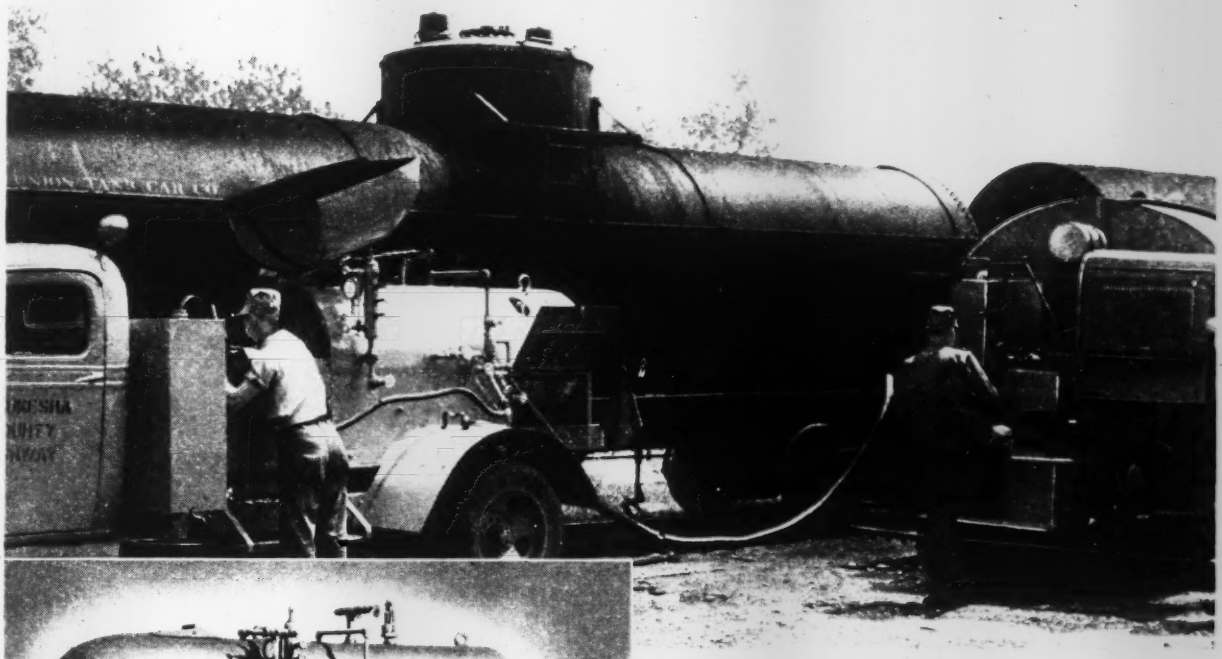
Admiral Behrens enlisted in the Navy as a seaman during the first World War. He was retired from active duty on July of this year after 30 years' service.

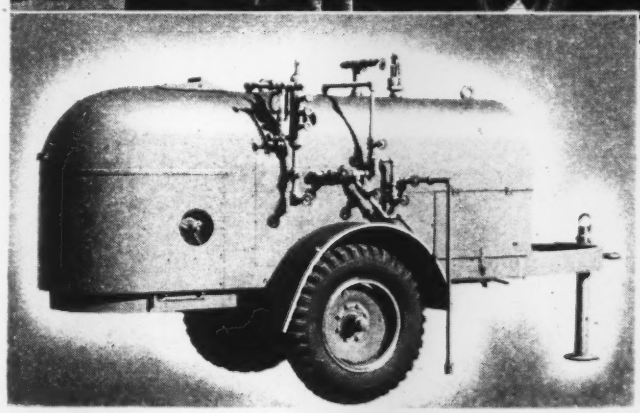
During World War II Admiral Behrens was executive officer on the Houston when that ship was torpedoed by enemy action.

Raymond D. Wygant, civil engineer who has been project engineer for the FPHA in Hawaii during the last two years, has gone to Seoul, Korea, to do "Master planning" with the 24th Army Corps. The new assignment concerns housing Dyall Leeright succeeds Mr. Wygant in Honolulu.

E. M. O'Connor has been appointed chief structural engineer of the Long Beach, Calif., department of building

"Johnny-on-the-SPOT" when you've got to pour it HOT!





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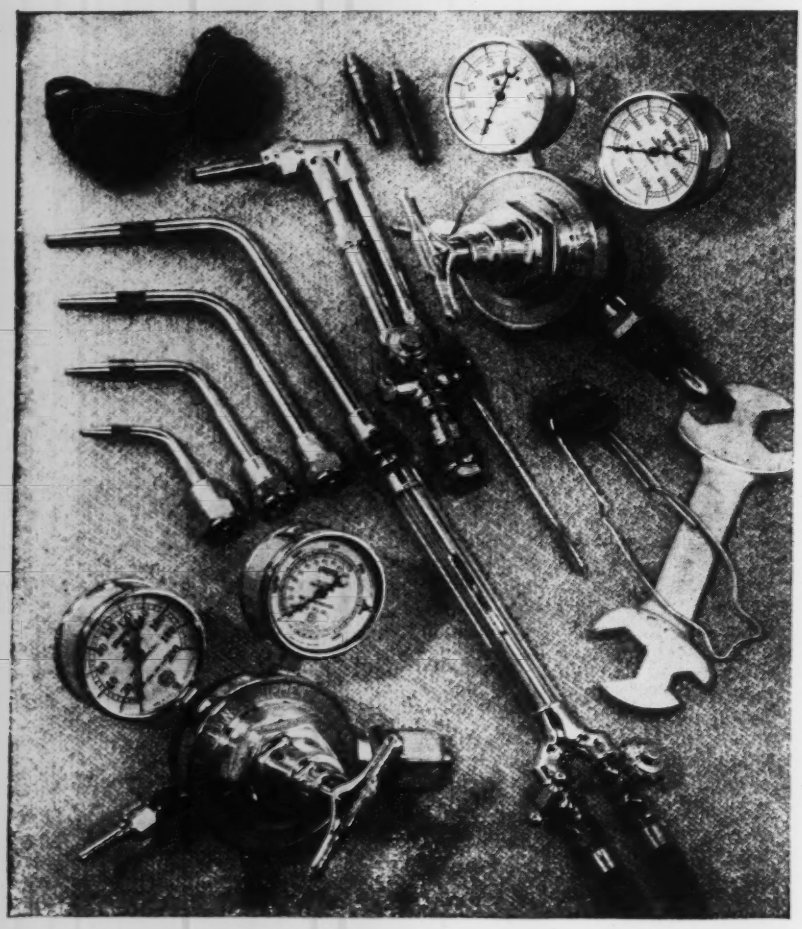

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on the construction job, particularly, a good gas welding and flame cutting outfit is a necessity. on a construction job, however, such an outfit is used largely for emergency repair, for hard facing, for silver brazing and for flame cutting—such an outfit, therefore, must be dependable . . . on the job when needed. and—that quality is one of the numerous reasons why victor welding and cutting equipment is today the most popular and one of the most highly regarded in industry.

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Ad 190

and safety; and O. F. Carey has been named chief building inspector. The appointment of both division heads was made by Superintendent Charles P. Morgan and were confirmed by City Manager Carl B. Wirsching.

Curtis D. Decker, city engineer of Bryan, Ohio, for nine years, has resigned to become city manager of Grafton, W. Va. He went to Bryan as resident engineer in 1938 when the sewage disposal plant was installed, and later became city engineer.

Roy W. Cox of Iola, has been appointed state highway director for Kansas by Governor Carlson. Mr. Cox was appointed to the state commission by the governor in 1939.

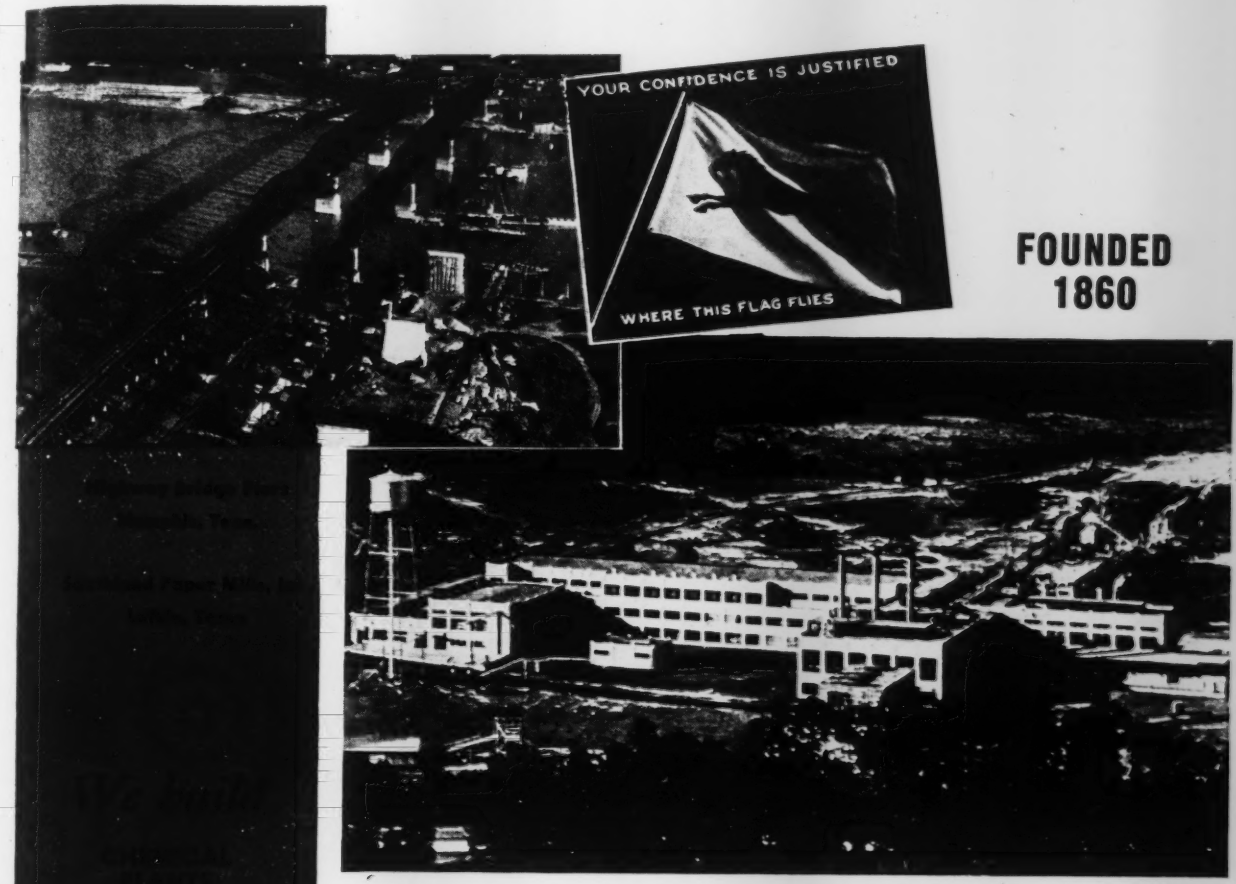
E. L. Cox of Vancouver, Wash., has recently been appointed resident engineer for the Crown-Zellerbach development at Camas, Wash. The work consists of a $16,000,000 extension to a paper mill and is expected to last about three years.

Charles W. Beamer who has resigned as city engineer of Fredericksburg, Va., will become town manager of Wytheville about September 15. He will be succeeded by D. A. Robertson in the Fredericksburg position. Beamer is a graduate of Virginia Military Institute.

William H. Klein, former vice-president and general operating manager of the Pennsylvania-Dixie Cement Co., has joined the staff of Gilbert Associates, engineers and consultants, Reading, Pa., specializing in problems relating to cement and rock products.

Col. Mark M. Boatner, Jr., district engineer for the Mobile, Ala., District for the last two years, is retiring and will be succeeded by Col. Joseph J. Twitty, of Pelham, Ga., who was intelligence officer on Admiral Nimitz's staff during the war and since then has been a member of the staff of the National War College in Washington, D. C.

James L. Bannon is in charge of field operations on the Ladd Field development at Fairbanks, Alaska. He spent a number of years in public works construction in the Chicago area but since the attack on Pearl Harbor he has been on Army construction work continuously—the last two years as chief civilian engineer at the Army Base on the Island of Shemya in the Aleutians. He is departmental engineer for Fay, Spofford and Thorndike of Boston who are Architect-Engineers for the Army's defense program in the Alaska theater.



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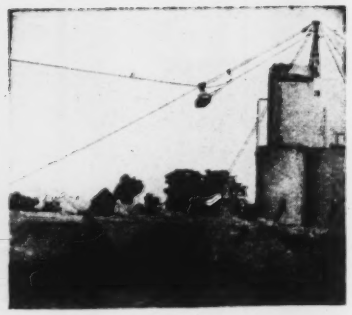

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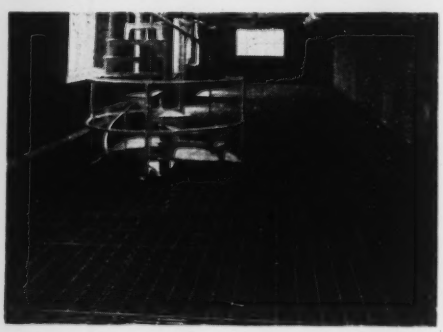

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New Engineering Books

(*Continued from page* 111)

THE EXPERIMENTAL STUDY OF STRUCTURES—By A. J. S. Pippard. 114 pp. Edward Arnold & Co., London. Longmans, Green & Co., New York. $2.50.

LESSONS IN ARC WELDING—3rd Edition—158 pp. The Lincoln Electric Co., Cleveland 1, Ohio. 50c. U. S. A. 75c. elsewhere.

TECHNICAL DRAWING PROBLEMS—By F. E. Giesecke, A. Mitchell and H. C. Spencer. 105 pp. The MacMillan Co., New York. $2.75.

PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS—Vol. IV, No. 2. 122 pp. Addison-Wesley Press, Inc., Cambridge 42, Mass.

ENGINEERING DRAWING—7th Edition—By Thomas E. French. 694 pp. McGraw-Hill Book Co., New York 18 and London. $3.75.

APPLIED THERMODYNAMICS—By V. M. Faires. 480 pp. The MacMillan Co., New York. $4.75.

SIMPLIFIED ENGINEERING FOR ARCHITECTS AND BUILDERS—2nd Edition—By Harry Parker. 245 pp. John Wiley & Sons, New York. Chapman & Hall, London. $3.00.

WHEN THE EARTH QUAKES—By J. B. Macelwane. 288 pp. The Bruce Publishing Co., Milwaukee 1, Wisconsin. $5.

CARPENTRY FOR THE BULDING TRADES—By E. A. Lair. 188 pp. McGraw-Hill Book Co., New York 18 and London. $2.50.

DOWN RAMP—THE STORY OF THE ARMY AMPHIBIAN ENGINEERS—By Brig. Gen. W. F. Heavey. 272 pp. Infantry Journal Press, 1115 17th St., N. W., Washington 6, D. C. $5.

Reports and Pamphlets

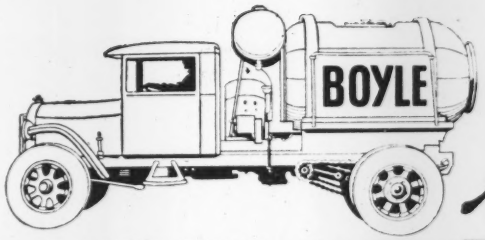
TRAFFIC PERFORMANCE AT URBAN STREET INTERSECTIONS—Technical Report No. 1—By B. D. Greenshields, D. Schapiro and E. L. Ericksen. Yale University, Bureau of Highway Traffic, Strathcona Hall, New Haven, Conn.

THE CAUSES AND EFFECTS OF SEDIMENTATION IN LAKE DECATUR—Bulletin No. 37—By C. B. Brown, J. B. Stall and E. E. DeTurk. State Water Survey Division, Urbana, Ill.

JOURNAL OF THE INDIAN ROADS CONGRESS—No. 4, Eleventh Session. Indian Roads Congress, Jamnagar House, Shahjahan Road, New Delhi, India.

BUILDING CONSTRUCTION COST DATA-1947—By Robert S. Means, P. O. Box 62, Duxbury, Mass. $2.

EFFECT OF ALCOHOLIC FERMENTATION AND GROWING OF FODDER YEAST ON B.O.D.



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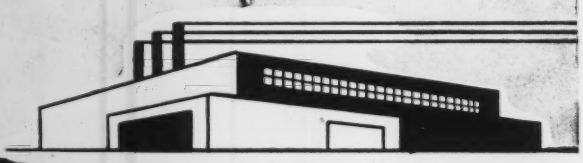

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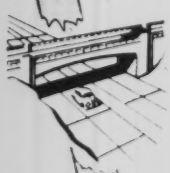

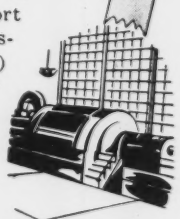

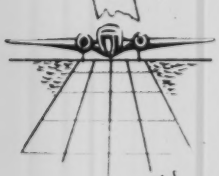

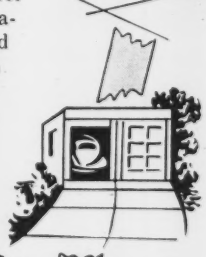

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OF SULPHITE WASTE LIQUOR—By Richard G. Tyler. Reprint No. 6. University of Washington Engineering Experiment Station, Seattle, Wash.

BUCKLING OF WEBS IN DEEP STEEL I GIRDERS—By George Wastlund and Sten G. A. Bergman. Royal Institute of Technology, Stockholm, Sweden.

BUILDING STONES OF CENTRAL TEXAS—By V. E. Barnes, R. F. Dawson and G. A. Parkinson. Bulletin No. 4246, University of Texas, Austin, Texas. $1 paper bound; $2 cloth bound.

MANUAL ON COLLECTIVE BARGAINING FOR PROFESSIONAL EMPLOYEES: Part I, The National Labor Relations Act and Professional Employees—By W. E. Fisher. Published by The Committee on the Economic Status of the Engineer of the Engineers' Joint Council. $1 from the American Society of Civil Engineers, 33 W. 39th St., New York 18.

STEP-BY-STEP PROCEDURE TO BE FOLLOWED BY FEDERAL-AID AIRPORT SPONSORS—W. R. Macatee, and THE RESPONSIBILITIES OF THE STATE IN THE DEVELOPMENT OF AN AIRPORT PROGRAM—By L. L. Schroeder. American Road Builders' Assoc., 1319 F. St., N. W., Washington 4, D. C. 75 c.

INFORMATION FOR AIRPORT SPONSORS—Bulletin No. 115. American Road Builders' Assoc., Washington 4, D. C. $1.

FUTURE LAND DEVELOPMENT IN BERGEN COUNTY — County Planning Board, Hackensack, New Jersey.

FIFTY YEARS OF PROGRESS—By J. S. Young. Lehigh Portland Cement Co., Allentown, Pennsylvania.

WASHINGTON—A PLAN FOR CIVIC IMPROVEMENTS—1947—Citizens' Planning Committees, Washington, D. C.

TRAFFIC SURVEY OF BATON ROUGE—1945—Department of Highways, Baton Rouge 4, Louisiana.

TRAFFIC SURVEY OF SHREVEPORT METROPOLITAN AREA—Department of Highways, Baton Rouge 4, La.

SEWERAGE SERVICE CHARGES—By S. R. Wright. Bulletin No. 98. Texas Engineering Experiment Station, College Station, Texas.

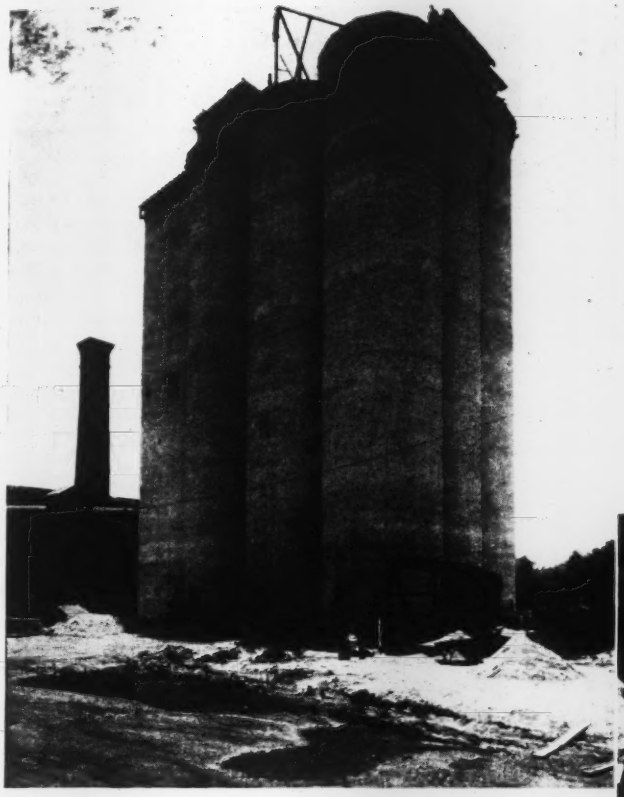
THE WILLARD CHEVALIER LECTURES—Engineering Experiment Station Series No. 54. Texas Engineering Experiment Station, College Station, Texas.

PROGRESS REPORT OF THE PRESIDENT'S HIGHWAY SAFETY CONFERENCE—For Sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 35c.

METHODS OF ACHIEVING PROFESSIONAL RECOGNITION—By W. F. Ryan. Reprinted from the *Journal of Engineering Education*, University of Pittsburgh, Pa.

FLEXIBLE PAVEMENT REQUIREMENTS FOR AIRPORTS—By W. R. Macatee, Technical Bulletin No. 118, American Road Builders' Association, 1319 F. St., N. W., Washington 4, D. C.

WILLIAM GALT RAYMOND—By B. J. Lambert. Centennial Memoirs. University of Iowa Press, Iowa City, Iowa.



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UNITED STATES STEEL

Elections and Activities

The New Mexico Society of Professional Engineers has organized an Albuquerque section. Elected as chairman is W. R. Underwood, project manager of the O. G. Bradbury Construction Co.; vice-chairman, Jack Cavaniss; secretary-treasurer, Robert Yearout, and state director, Bernard C. Moore.

E. K. Van Winkle, president of Van Winkle and Co., Atlanta construction firm, has been elected president of the Georgia branch of the Associated General Contractors of America. A graduate of Georgia Tech in the class of 1924, Mr. Van Winkle served as vice-president of the association last year. Other officers elected included Ira H. Hardin, president of Ira Hardin Company, Atlanta, and Merrill W. Newbanks, partner of Donnellan-Newbanks Co., Atlanta, vice-presidents; A. J. Collins, treasurer; J. J. Black of Black and Munn, Atlanta, secretary, and Hugh Robert, executive secretary.

The Structural Engineers Council of Jacksonville, Fla., has been organized with 16 charter members and officers elected as follows: J. F. Shea, president; R. W. Cloues, vice-president, and P. M. Huddleston, secretary-treasurer. The council was formed to represent registered professional engineers practicing structural engineering.

A group of leading general building contractors in the Jamestown, N. Y., area has formed a trade organization to promote "the maintenance and constant improvement of skill, integrity and responsibility of the members and their employees." Incorporated as the Jamestown Builders Exchange, Inc., the organization has the following directors: Lee Bull, Myrl L. Cady, John P. Erickson, Charles Ludwig, John P. Peterson, Andrew Scalise, Paul A. Rogerson, Clifford G. Olson and William Gleason. One of the aims of the Builders Exchange is the reduction of building costs, and the passing along of these savings to the general public.

A Mid-Willamette valley chapter of the Oregon Society of Professional Engineers has been organized at Salem. William Hill, engineer for the state aeronautics commission, was elected temporary chairman, and C. A. McClure, engineer for the Salem long-range planning commission, temporary secretary.

-CHOATE

PRODUCT OF IOWA

MOTO-SCRAPERS

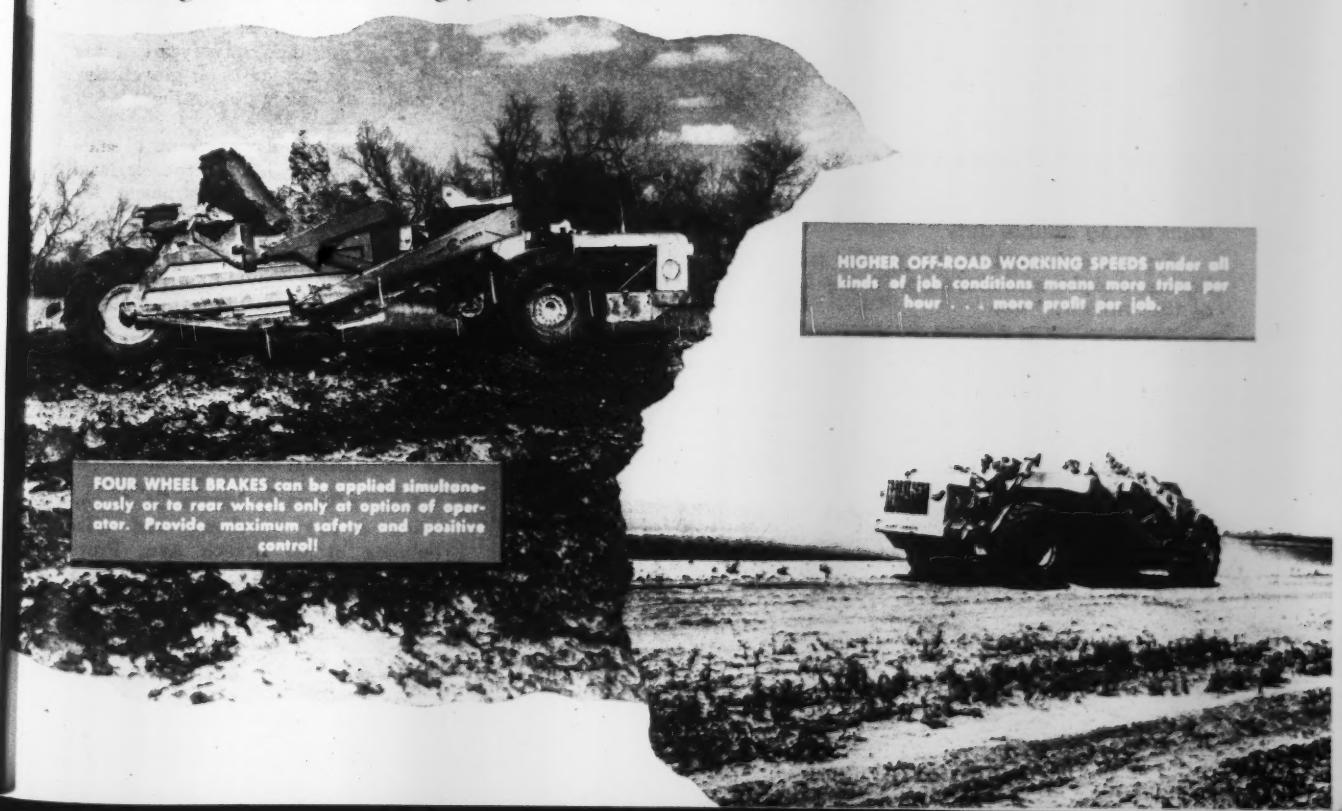
give you all the features that pay off in extra profits!

Check these features and see why owners and operators . . . in every section of the country . . . in ever increasing numbers . . . are turning to the new LaPlant-Choate MOTO-SCRAPERS.

Tested for more than two years before it was announced, this new high-speed earthmover has every feature necessary for moving more material at a minimum of cost. The big 225 h.p. engine has ample power to handle 17 to 18 yard heaped loads in high gear to save valuable minutes on every trip. Finger-tip hydraulic steering thru double-acting jacks eliminates jackknifing and provides maximum maneuverability and stability in rutted and heavy going. 60 h.p. gas starting engine assures quick starting in any weather.

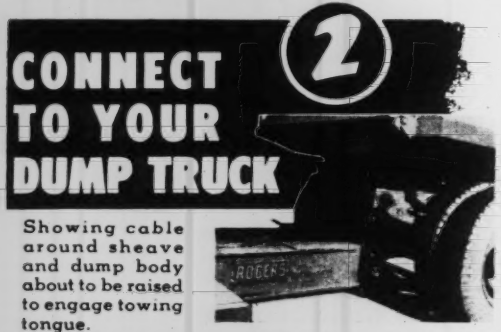
These and dozens of other features make the MOTO-SCRAPER the most modern earthmoving unit on the market today.

See your nearest LPC dealer for complete details and delivery dates. Ask for booklet number 1154. LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa; 1022 77th Ave., Oakland 3, Calif.



HIGHER OFF-ROAD WORKING SPEEDS under all kinds of job conditions means more trips per hour . . . more profit per job.

FOUR WHEEL BRAKES can be applied simultaneously or to rear wheels only at option of operator. Provide maximum safety and positive control!



Showing cable around sheave and dump body about to be raised to engage towing tongue.

Body elevated. Tightened cable has raised drawbar and engaged towing tongue. Safety coupling pin is inserted.

A welcomed boon to contractors everywhere, the "Tagalong" frontloader requires no tractor. Light and medium shovels, cranes, bulldozers, etc., are moved to and from the job rapidly and economically, with your dump-truck doing double-duty.

Equipment used to adapt the truck constitutes a negligible weight and does not in the least impair usefulness of the vehicle.

THE INSTALLATION IN NO WAY OBSTRUCTS THE DUMP BODY OR ITS NORMAL OPERATION.

Write for particulars.

ROGERS BROS. CORP.

DESIGNERS and BUILDERS OF HEAVY DUTY TRAILERS SINCE 1915

EXPERIENCE builds 'em PERFORMANCE sells 'em

135 ORCHARD ST. ALBION, PENNA.

Manufacturers' Activities

GUSTAVE TREFFEISEN has been made sales manager of the Alemite distribution division of Stewart-Warner Corp., succeeding Charles I. Kraus, who becomes distributor at Minneapolis, Minn.

DETROIT DIESEL ENGINE division of General Motors Corp. has assigned Lauren H. Wells as sales engineer for the Northern Pacific Coast Zone, and Victor Hansen will take over the southern west coast zone.

FARMALL WORKS is planning an addition to its manufacturing space, L. M. Gildea, works manager of International Harvester's Rock Island, Ill., tractor plant has announced.

NEW HOLLAND METALS CO., Leola, Pa., is offering aluminum corrugated and 5v-crimp roofing and siding, plain aluminum ridge roll and aluminum roofing nails, as well as aluminum plain sheets for heating and ventilating duct work.

E. A. BUXTON has been elected chairman of the committee on steel pipe research of the American Iron and Steel Institute, succeeding E. P. Corey, retiring after 52 years in the steel pipe industry.

EAGLE IRON WORKS, Des Moines, Iowa, recently celebrated its 75th anniversary. For that many years it has been serving the sand and gravel, clay products and mining industries.

Assignment of a new group of sales engineers to the branch and regional offices of the Brown Instrument Co. has been announced. They are: Edgar Andrews, Atlanta; Nilsson S. Bassett, Boston; R. J. Bierman and Clarence W. Swanson, Minneapolis; Edward J. Bryne, Houston; Warren H. Erftenbeck, Buffalo; David J. Fair, Dallas; William R. Hamaker, Detroit; Charles F. Hintz, Chicago; Lawrence W. King, New York; Donald W. Larcen, Milwaukee; John F. Smith, Tulsa, Okla., and Andrew H. Albee, Cleveland, Ohio.

CHASE, BRASS & COPPER CO. is now using a new warehouse and office building at 66 Branch Ave., Providence, R. I.

During the first six months of this year Otis Elevator Co. has installed

ACCEPTING THE CHALLENGE

Architect Mortimer J. Murphy, Buffalo. General Contractors: Balling Bros. & Hollet Bros., Tonawanda, N. Y.

Mercy Hospital, Buffalo, is accepting the challenge of the times for increased hospital facilities by adding three wings, two of 7 stories and one of 8 stories, to the existing 8-story brick structure. Spacious and attractive, the new wings will be equipped with the latest facilities for the treatment of patients.

Like hundreds of other structures now being built throughout the nation, this hospital addition will have a framework built of Bethlehem Structural Shapes.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

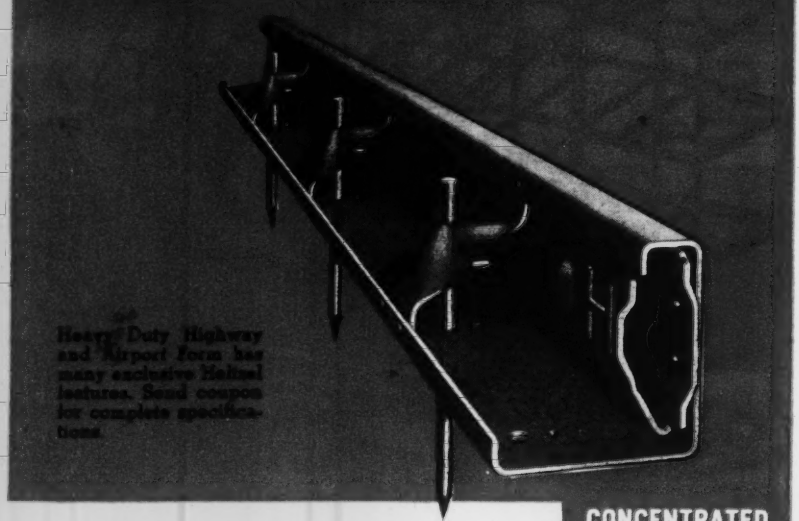
Bethlehem

STRUCTURAL SHAPES

★ BETHLEHEM STEEL ★

build better with

HELTZEL STEEL FORMS



Heavy Duty Highway and Airport Form has many exclusive Heltzel features. Send coupon for complete specifications.

HIGHWAYS

CURBS

CURB AND GUTTER

SIDEWALK

AIRPORT

The heavy duty highway and airport forms have several exclusive Heltzel features . . . 2½" tread . . . up-turned base flange — 50% additional strength . . . extended lock joint guide . . . hot pressed ¼" lock joint — V type eliminates clogging . . . non-clogging single wedge stake pockets that are not affected by vibration. The base flange is also drilled for auxiliary stakes or bolting on risers. The $\frac{7}{32}$" form is recommended for all construction up to 20' widths. The ¼" form is recommended for construction over 20' in width. Both forms meet all highway specifications.

Heltzel also has steel forms for curb, combined curb and gutter, sidewalk, rigid radius and flexible radius.

CONCENTRATED *Engineering* **IN CONCRETE CONSTRUCTION**

Heltzel BUILDS IT BETTER

- BINS, Portable and Stationary
- CEMENT BINS, Portable and Stationary
- CENTRAL MIXING PLANTS
- BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)
- BITUMINOUS PAVING FORMS
- ROAD FORMS (with lip curb and integral curb attachments)
- CURB FORMS
- CURB AND GUTTER FORMS
- SIDEWALK FORMS
- SEWER AND TUNNEL FORMS
- CONCRETE BUCKETS
- SUBGRADE TESTERS
- SUBGRADE PLANERS
- TOOL BOXES
- FINISHING TOOLS FOR CONCRETE ROADS

Heltzel Steel Form & Iron Company, Warren, Ohio

SEND ME STEEL FORM CATALOGS:

[ ] B-19 Steel Highway and Airport Forms

[ ] B-19A Steel Dual Duty Airport Forms

[ ] A-20 Steel Forms for Curbs or Curb and Gutters or Sidewalks.

Name_____

Address_____

(Type of construction usually engaged in)

HELTZEL STEEL FORM & IRON CO. WARREN, OHIO · U. S. A.

escalators in 17 department stores in the United States, and scores of additional units are now being installed.

ABOUT 350 FENESTRA representatives from all parts of the U. S. will attend a national sales convention at Detroit, Mich., Sept. 18-20—the first the Detroit Steel Products Co. has held since 1940.

Belief that it can hold the price line on window and plate glass as a curb to rising building construction costs has been expressed in Toledo, Ohio, by the Libbey-Owens-Ford Glass Co. as the outgrowth of a mutual pledge by management and labor calling for increased production. G. P. MacNichol, Jr., vice-president in charge of sales, notified customers that the company policy of guaranteeing glass prices on identified construction projects will continue and be extended to cover Thermopane, the company's insulating window.

L. W. COFFIN and L. W. WHITTON have been elected vice-presidents of the Otis Elevator Co. Mr. Coffin has been general service manager two years, and Mr. Whitton has been manager of operations since last Oct. 1. Both will continue in those posts.

THE ASPHALT INSTITUTE has announced the appointment of Herbert Spencer as district engineer for New York and New Jersey to provide more intensive engineering coverage in the metropolitan area. He continues as secretary of the Institute. The Institute also elected Wallace D. Craig of Standard Oil Co. of New Jersey as vice president of Division I, comprising the Atlantic-Gulf territory.

Recognition of the earthmoving industry in future national emergencies is indicated by the election of ROY E. CHOATE, president of LaPlant-Choate Manufacturing Co., Inc., Cedar Rapids, Iowa, as the director of the Quad-Cities-Iowa Post, Army Ordnance Association. The civilian activities of this program are centered around the work of the Army Ordnance Association whose members include the principal industrial leaders of the country. It works closely with the armed services and the Army-Navy munitions board in making known the latest scientific and mechanical knowledge, keeping them informed of new products and developments, and appraising the overall manufacturing facilities of the company in the event of national emergencies.

LINK-BELT CO., Chicago, Ill., announces the following promotions: Ralph W. Rausch has been appointed chief engineer. He succeeds C. S. Hunt-

THANKS TO THE LOCAL DISTRIBUTOR

DURING THE WAR when prompt product procurement was vital to uninterrupted and constantly increased production, distributors played a major part in finding product sources, breaking bottlenecks, unsnarling delivery tangles.

In present peacetime days, with their profit-imperilling shortages and delays, distributors continue an essential factor in the efficient flow of construction items from factory to job site.

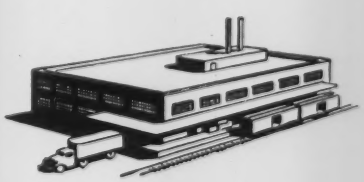
To assure speedy purchase and "on schedule" arrival of construction items distributors . . .

- develop intimate knowledge of all potential product sources . . . maintain friendly personal contact with numerous manufacturers and with other distributors
- locate and expedite delivery of hard-to-find items in small or large quantities . . . a service that includes personal calls on sources of supply by distributors' men, telephone, telegraph, and mail service
- compile catalogs packed with detailed product information helpful to buyers
- operate dependable routine and emergency delivery service between warehouse and job site
- stock hundreds of readily available items in local warehouses in anticipation of buyers' needs

Procurement services like these, plus the distributor's familiarity with construction problems which enables him to suggest substitute products and alternative methods when necessary, contribute substantially to lower construction costs. That's why economy-minded construction men the country over fill their product needs through their local distributor.

Make Distributor's Headquarters Your Service Headquarters

No. 4 in a series of advertisements sponsored by ENGINEERING NEWS-RECORD and CONSTRUCTION METHODS showing how distributor services aid economical construction



NOW Rolled from Alloy or Mild Steel

Caine CORR-PLATE Steel Piling

ROLLED FROM A NEW STEEL ALLOY, Caine Corr-Plate is now 25% stronger and has nearly 100% greater corrosion resistance This alloy makes available equal strength and nearly double the life in a 25% lighter piling. Approved by Highway Departments and U. S. Engineers.

Caine Corr-Plate Steel Piling has been used the world over for Foundations, Dams, Retaining Walls, Docks, Levees, Bulkheads, Sewers, Disposal Plants and Hundreds of other jobs—It's stronger, lighter, nestable, easy to drive and water tight; can be re-used again and again.

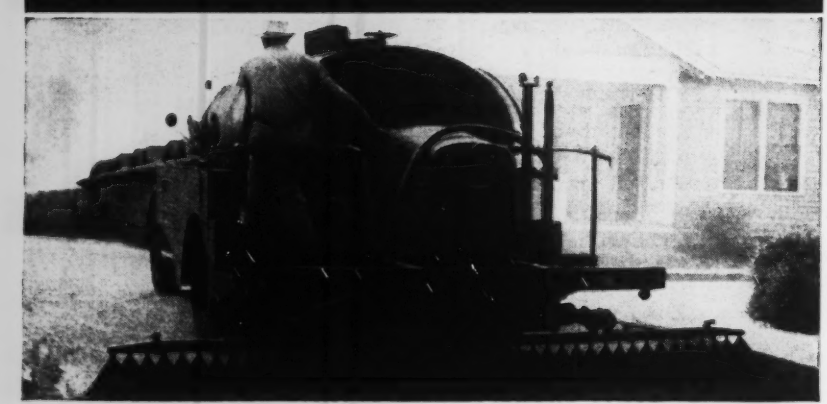
Doubled life and 25% greater strength make Caine Corr-Plate Steel Piling the bargain buy in piling!

NOW, MORE THAN EVER BEFORE . . .
STRONGEST PER POUND WEIGHT

CAINE STEEL COMPANY
STEEL PILING DIVISION, 1820 N. Central Avenue, Chicago 39, Illinois

2278

ETNYRE
"Black-Topper"
BITUMINOUS DISTRIBUTORS



ACCURATE...DEPENDABLE...ECONOMICAL—Reduce labor costs, save time, minimize maintenance with an Etnyre "Black-Topper". Covers roads up to 24 feet wide in one trip... low-cost operation... accurate and dependable. See your Etnyre dealer or write us today for complete details.

E. D. ETNYRE & CO., Oregon, Illinois

ington, who has retired because of ill health. H. Walter Regensburger has been appointed divisional engineer in charge of estimate-engineering at the Pershing Road plant.

The appointment of INDUSTRIAL AND MARINE EQUIPMENT CORP., 1001 Sibley Tower Bldg., Rochester, N. Y., as distributors of General Motors Series 71 marine and industrial diesel engines has been announced by the Detroit Diesel Engine Division, General Motors Corp. It is headed by Alvin E. Alvey.

New purchasing agent for the HYSTER Co., Portland, Ore., manufacturers of lift and straddle trucks and tractor equipment, is Paul Rhodes.

Announcement has been made of the election of S. R. IVES as president of Armco Drainage and Metal Products, Inc., Middletown, Ohio. M. C. Patton has been elected executive vice president and H. D. Neill, vice president in charge of sales. Messrs. Ives and Patton have also been elected president and executive vice president respectively of Armco Drainage and Metal Products of Canada, Ltd.

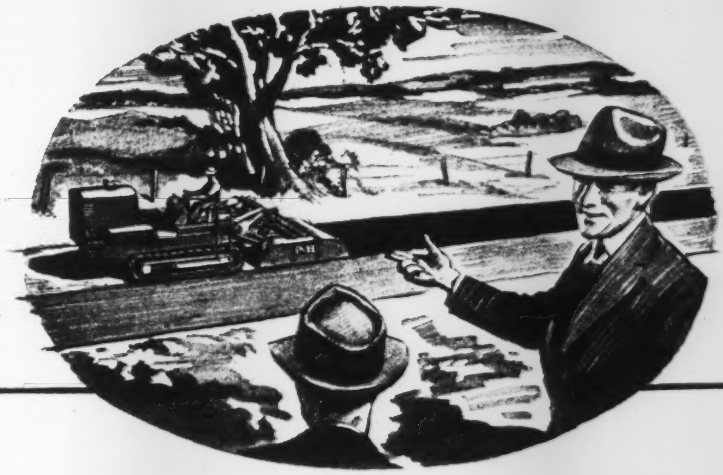
WALTER C. RUECKEL, New York District sales manager for the engineering & construction division of Koppers Company, Inc., since 1945, has been appointed a vice president of the company.

Production of plate glass is being resumed at the Rouge plant of the FORD MOTOR CO.

C. A. WILSON has been appointed research engineer of the Committee on Reinforced Concrete Research, American Iron and Steel Institute, New York. He fills the vacancy created by the recent death of Roy Zipprodt.

UNITED STATES RADIATOR CORP., Detroit, Mich., has announced the appointment of Hanley H. Smith as branch manager for the corporation and its Pacific steel boiler division at Washington, D. C.

UNITED STATES PIPE AND FOUNDRY Co., Burlington, N. J., announce the following sales department changes: In the San Francisco office, A. Raymond Hausmann has been appointed Pacific Coast sales manager and P. King Farrington, assistant Pacific Coast sales manager. In Chicago Carl N. Brown has become Western sales manager and J. Leslie Hart, assistant Western sales manager. In Birmingham, Thomas W. McCreery is Southern sales manager and Robert C. Lemert, assistant Southern sales manager.

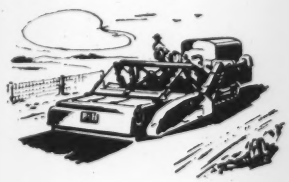


THE EIGHT "MUSTS" IN A SINGLE PASS

Cut the Cost of Road Building

Road building reaches a new high point in mechanized operation with the P&H Single Pass Stabilizer. For here, in one machine, is the ability to fulfill these 8 basic requirements with *definitely pre-determined results.* This can be done under varying conditions — with or without any type of admixture.

1. Control processing depth for accurate proportioning.
2. Pulverize the soil thoroughly.
3. Blend materials uniformly.
4. Create a true sub-grade.
5. Disperse the liquid through the entire volume in measured quantity.
6. Mix the coated material uniformly.
7. Lay the completely processed material in a fluffy, even depth, ready for compaction.
8. Do all these things in one pass — at a good rate of speed.



In one season, a P&H Single Pass Stabilizer built 1,000,000 sq. yards of stabilized soil roads, mixing imported sand with existing roadway soil.

The greater utilization you can make of native, in-place materials, the more substantial savings you make in building good, all-weather roads.

If you contemplate the construction of base courses, secondary roads, airport runways, etc., investigate the accomplishments of the P&H Single Pass Stabilizer under soil conditions resembling your own. Ask us for the facts.

P&H **SINGLE PASS STABILIZERS**

4404 West National Avenue
Milwaukee 14, Wisconsin

HARNISCHFEGER CORPORATION

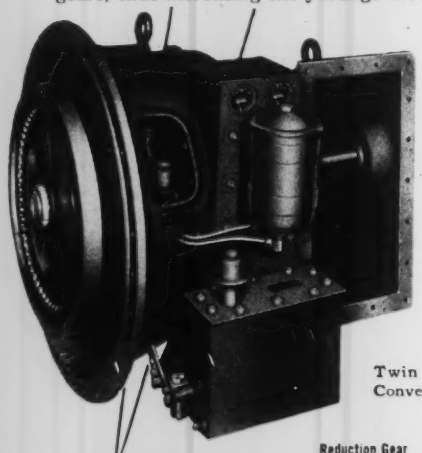
EXCAVATORS · ELECTRIC CRANES · ARC WELDERS · HOISTS · WELDING ELECTRODES · MOTORS

MORE PUSH... MORE PULL...
More Yardage Moved

Shown bulldozing heavy shale on U. S. 27 near Alexandria, Ky., is the new Allis-Chalmers HD19 Tractor equipped with a Twin Disc Torque Converter.

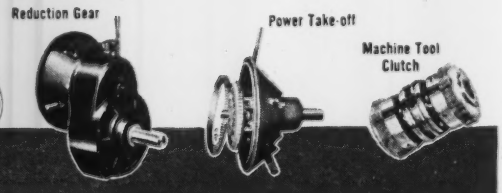
Tractors equipped with Twin Disc Hydraulic Torque Converters are moving 20% more yardage than conventional tractors at one-half the upkeep cost. These Twin Disc units are designed for use wherever it is advantageous to multiply torque for constantly-changing speed and load requirements.

Continuous smooth operation in starting, pushing, and pulling is assured with a Twin Disc Torque Converter. There is uninterrupted acceleration . . . less operator fatigue. Time and momentum of the load are not lost in shifting gears, thus increasing the yardage moved.



Twin Disc Hydraulic Torque Converter (Lysholm-Smith type).

Proved in a wide variety of applications . . . tractors, cranes, hoists, yarders and loaders . . . Twin Disc Hydraulic Torque Converters deliver smooth power, make accurate control possible, and prevent stalling. Write the Hydraulic Division for Bulletin No. 135-B. TWIN DISC CLUTCH COMPANY, Racine, Wisconsin (Hydraulic Division, Rockford, Ill.)



TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES
REG. U. S. PAT. OFF.

SPECIALISTS IN INDUSTRIAL CLUTCHES SINCE 1918

Manufacturers' Publications

Building Savers—(16-p. catalog) Covers floor treatments, concrete and mortar admixtures, waterproofing and dampproofing products, paints and protective coatings, caulking compounds, roof coatings and waxes. It gives coverage figures, packaging data and, in several instances, thumbnail application suggestions.—*Building Products Division, L. Sonneborn Sons, Inc., New York 16, N. Y.*

Metal forming—(64-p. catalog) Illustrates methods and tools for forming metal shapes used in structural and architectural fields. Typical die designs for various shapes are illustrated.—*Cincinnati Shaper Co., Cincinnati 25, Ohio.*

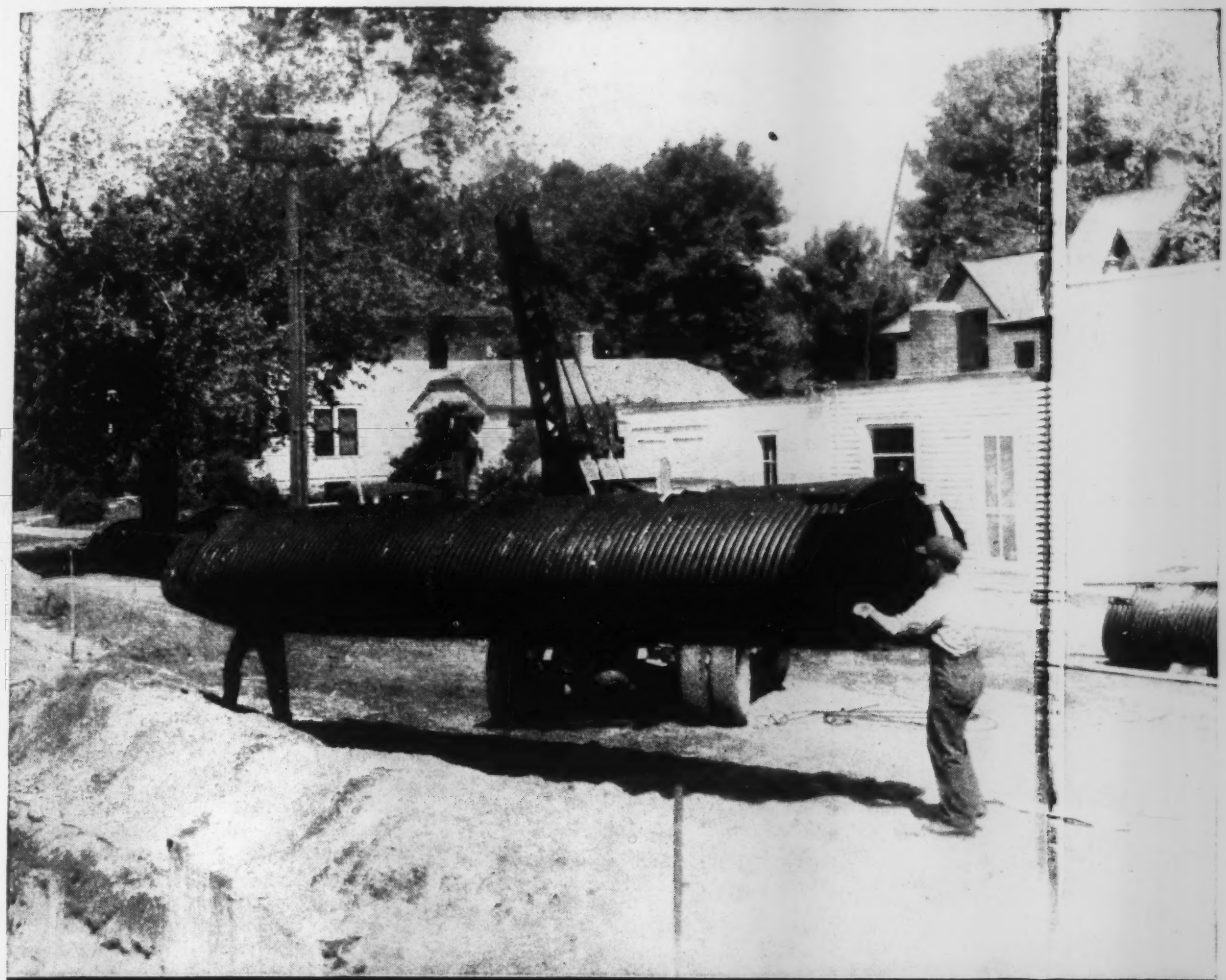
Slurry Pump — (16-p. pamphlet) Contains performance charts showing how to select slurry pump to insure maximum life of wearing parts and describes advanced design of Type R pump.—*Morris Machine Works, Baldwinsville, N. Y.*

Heavy-Duty Engines—(16-p. booklet) Describes and illustrates four heavy-duty diesel engines ranging in size from 180 to 300 hp. It gives construction features, details regarding combustion, installation and design with illustrations of installations.—*Buda Co., 154th & Commercial Ave., Harvey, Ill.*

Engineering Instruments—(50-p. illustrated catalog) Includes detailed analyses of transits, engineers' levels, precise leveling rods, alidades and topographic instruments and equipment. Hydraulic measuring instruments, water level recorders and indicators, field supplies and wind instruments are also discussed.—*W. & L. E. Gurley, Troy, N. Y.*

Oil-Field Electrification — (109-p. textbook) Covers electrical equipment and methods in oil-producing and pipeline industries.—*General Electric Co., Schenectady, N. Y.*

Admixture for Ready-Mixed Concrete—(2-p. bulletin) Describes how Trimix, multi-purpose liquid admixture, is used in manufacture of ready-mixed concrete.—*Building Products Division, L. Sonneborn Sons, Inc., 88 Lexington Ave., New York 16, N. Y.*



Where headroom is limited—where you have to "duck" under an intersection or railroad, for example—ARMCO Pipe-Arches offer an ideal solution. Like other types of ARMCO Asbestos-Bonded Sewer Pipe, these arches are strong, light in weight, easy to handle, and assure years of low-cost trouble-free service.

Speed On The Job... *Easy On The Budget*

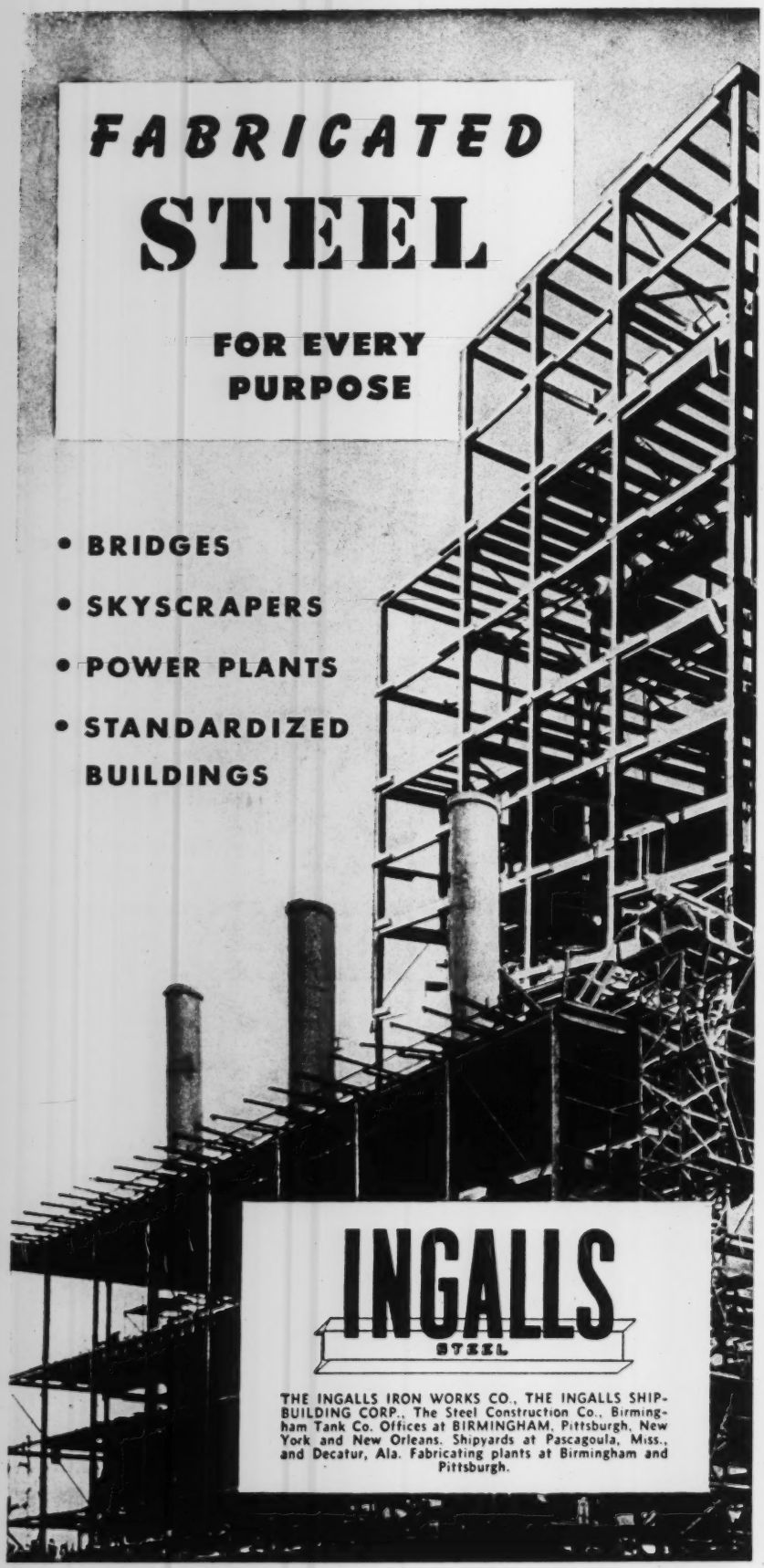
Installing ARMCO Asbestos-Bonded Sewer Pipe is easy . . . simple . . . fast. The long, light-weight pipe sections are lowered into place and securely coupled in jig-time. No curing and speed is the word — the kind that saves money, work, valuable days.

And for all its speed-on-the-job, there is no worrying later — your maintenance and replacement budgets can "relax." ARMCO Corrugated Pipe has the flexibility to withstand vibration, impact and heavy dead loads. Asbestos-Bonding plus a thick bituminous pavement in the bottom stoutly resist corrosion and erosion. And where there is not enough headroom for round pipe, ARMCO Pipe-Arches could well be the answer.

An experienced Armco Engineer will gladly give you full information — sizes, prices, delivery data — on ARMCO Asbestos-Bonded Sewer Pipe. Write our nearest office for full data. Armco Drainage & Metal Products, Inc., 735 Curtis Street, Middletown, Ohio.

ARMCO

Armco Asbestos-Bonded Sewer Pipe


FABRICATED
STEEL
FOR EVERY PURPOSE
• BRIDGES
• SKYSCRAPERS
• POWER PLANTS
• STANDARDIZED BUILDINGS
INGALLS
STEEL
THE INGALLS IRON WORKS CO., THE INGALLS SHIPBUILDING CORP., The Steel Construction Co., Birmingham Tank Co. Offices at BIRMINGHAM, Pittsburgh, New York and New Orleans. Shipyards at Pascagoula, Miss., and Decatur, Ala. Fabricating plants at Birmingham and Pittsburgh.

Engineering School News

Appointment of Waldo Shumway, scientist, professor and former assistant dean of the college of liberal arts and sciences of the University of Illinois as dean of Stevens Institute of Technology has been announced. Dr. Shumway will fill the position which Dean Frederic E. Camp leaves upon his promotion to the position of assistant to the president.

Joe R. Hendrickson of Birmingham, Ala., will teach at Vanderbilt University school of engineering this fall. Since his discharge from the Army he has been employed by the E. Phil Harris Co. of Birmingham.

Robert W. Andres has been appointed assistant professor of civil engineering, at the University of Idaho. A graduate of the University of Minnesota, he has had four years' experience in engineering and served five years in the Army.

Ten graduate fellowships in traffic engineering have been announced by Yale University. They provide $1,400 each and enable recipients to engage in a full academic year in graduate study in traffic engineering at the Yale Bureau of Highway Traffic. Five men were awarded scholarships providing for the payment of tuition fees. Nine of the fellowships were made possible by the Automotive Safety Foundation. Preference was given to those men now employed in street and highway engineering. One fellowship was based upon a grant from the American Transit Association. This one, known as the Gordon-Case Memorial Fellowship, was designated for one especially interested in urban transportation problems.

Howard J. Hansen, who served as associate professor in charge of hydraulics and hydrology in the University of Florida's civil engineering department during the last year, has been promoted to professor of mechanics and acting head of the industrial engineering department. Professor Hansen had been a faculty member at Tulane University and A. and M. College of Texas before joining the University of Florida staff. He is an authority on timber structures and plywood. He is chairman of the ASCE committee on timber structures. He received his B.S.C.E. and C.E. degrees from Purdue University and Tulane University respectively.